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NOTICES—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Communications relating to advertisements or general matters should be addressed to the Manager.

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Comparison of Chemical Prices

AN instructive comparison has been made between the prices of chemicals, drugs, dyes and colours covered by the Board of Trade returns of imports and exports for the first six months of 1922 and 1923. Taking first the total imports, the declared value was £5,354 in 1922 and £6,863 in 1923 (or £7,829 on the 1922 prices). The average value in 1923 was 87.7 per cent. of 1922, while the average quantities were 146.2 per cent. In the case of "imports retained," the declared value was £4,610 in 1922 and £6,164 in 1923 (or £6,950 on the 1922 prices); the average value in 1923 was 88.7 per cent. of 1922, and the average quantities 150.8. Turning to the exports of United Kingdom produce, we find that the average value of chemicals, etc., in 1923 was 92.6 per cent. of 1922, while the average quantities amounted to 136 per cent. The figures of declared value are £10,416 for 1922 and £13,120 for 1923 (or £14,163 on the 1922 prices). The exports of Foreign and Colonial produce show that the average values of chemicals, etc., in 1923 were 79.5 per cent. of 1922, and the average quantities 118.1 per cent. The actual figures of declared value are £744 in 1922 and £699 in 1923 (or £879 on the 1922 prices). It will thus be seen

that while values have fallen appreciably the quantities have increased to such a degree that the total trade, expressed in cash value, shows a decided advance.

In the United States the prices of chemicals continue downward, the decline for June being estimated at 2 per cent. The movement brought quotations for industrial chemicals to the lowest point touched during 1923, but on the whole the first six months of this year is described as "really the first sustained period of prosperity since the 1920 slump." The position is not regarded as alarming, the lower prices being attributed to reduction in the cost of raw materials, while the increased cheapness may result in more trade. In the case of certain chemicals, it is reported that goods of foreign origin have had considerable influence in depressing values. Heavy shipments from abroad have gone to America, and home prices have had to be adjusted and readjusted to attract buyers. It is believed, however, that most of the big chemical consuming industries are short of chemicals, and that a spurt in industry generally would react at once on the chemical industry. Chemical traders in the United States express some confidence that the turning point is close at hand.

The Passing of the Twelve-Hour Shift

IT has frequently been said by those who have made a study of social and economic problems that, except in certain well-defined cases, this country in pre-war days was not noted for its efficient production. This is a truism which few will be prepared to question, for, if any excuse is needed for the rather apathetic spirit in which the output problem has been treated, the responsibility can be definitely placed upon the relatively low wages which prevailed before the war, and which, in conjunction with longer working hours, enabled us to carry on and in many cases to earn profits on a scale which could certainly be described as satisfactory. Now, however, we are faced with a situation bearing an entirely different complexion. Rates of wages have been measurably increased and the hours of labour have been reduced, so that the manager of an industrial undertaking to-day finds himself far less concerned with the technique of his particular process than with problems of an administrative nature which all come down to the one vital question of output. In reviewing the situation as one finds it to-day, it is not, perhaps, possible to do better than quote Mr. J. E. Powell, whose little volume on "The Output Problem" should lie on the desk of every works manager. A full recognition of all the factors which enter into and affect production is capable of ensuring success. As Mr. Powell says, the old policy

of exploiting labour in the direction of low wages is obsolete and must give way to the more enlightened and more profitable exploitation of the possibilities of administration and organisation in the interests of low costs. The casual observer is inclined to conclude that shorter working hours must inevitably be followed by increased costs of production, forgetting that, with the introduction of labour-aiding machinery, output may be speeded up; while, as a result of our experience during the war, we have learned a great deal that was never before known about intensive and mass production.

We have referred to the matter for the reason that we have lately been privileged to see a copy of the report which has been issued by the Federated Engineering Societies of America, who have made a most exhaustive analysis of the effect of the twelve-hour shift. The report is particularly pertinent so far as our own country is concerned, for we have a number of industries which have necessarily to proceed throughout day and night and from week to week, and which are generally known as "twenty-four hour industries." In past years it was customary in many instances to split the twenty-four hours into two shifts of twelve hours each; but recently the twelve-hour shift has largely disappeared and has been replaced by three shifts of eight hours. The American Committee's investigations show that in that country about one million workers depend on shift work, and that some 70 per cent. of these are now on the eight-hour shift. Moreover, it is shown that the fear of high production costs per unit of production is unfounded, for the reason that the very fact of the initial cost being higher is an incentive towards the improvement of equipment and the development of processes. The experience, in fact, is parallel with that over here—namely, that where, for example, twelve men were formerly employed on a long shift, only eight men are employed on a short shift, so that in the aggregate the numbers engaged are not added to. Socially, an improvement is registered in that instead of being unskilled workers the men are associated with machinery and given greater responsibilities than formerly, so that in a sense they become craftsmen. As one American writer says, shorter hours, less exhausting labour, and liberal wages, which are made possible with well-designed equipment, make intelligent workers who are far more profitable than stolid labourers hired to withstand deadening monotony and blistering heat.

Sulphate or Chloride of Ammonia

READERS of THE CHEMICAL AGE will no doubt recollect that in the past some of our contributors and correspondents have expressed the view that sulphate of ammonia might eventually be displaced by the chloride, and they have pointed to the advantages which the latter compound offers for fertiliser purposes as contrasted with its older rival. The problem of the respective merits of the two salts of ammonia was a year or two back quite a popular subject for discussion, but recently it seems to have fallen somewhat into the background. It is worth while recalling, however, that Dr. E. B. Maxted once

remarked in these pages that although experience with the chloride is limited, it possesses the advantage of containing 26.2 per cent. of nitrogen, as against the 21 per cent. of sulphate, the difference from the point of view of transport being important, since about four tons of chloride will do the work of five tons of sulphate. It has yet, however, to be shown whether there is any difference between the two compounds from the standpoint of the relative velocities at which crops react to the nitrogen they contain. It must not be overlooked, of course, that, by recovering ammonia as the chloride, carbonate of soda can be produced as a by-product.

Interest is now drawn to the whole matter by a report emanating from the office of the American consul-general at Frankfurt, to the effect that new methods of recovering ammonium chloride are now being employed in Germany. The report states that before the war the production of sulphate of ammonia in Germany was easily undertaken in connection with the distillation of coal. The process was simple, so long as sulphuric acid was cheap and available in sufficient quantities. The impossibility of importing sufficient pyrites during the war forced the owners of coke ovens to seek other processes of deriving ammonia, the conditions being that a cheap source of raw material to substitute sulphuric acid should be found, and a fertiliser salt produced that would not be inferior to the sulphate.

Such a salt is chloride of ammonia, and extensive experiments concerning its production have been carried out. The final shape which the process has taken is not specifically stated, but it would seem that it consists in converting the ammonia and carbonic acid with common salt on the lines of the Solvay process, and it is considered that the chloride obtained in this way can readily compete with sulphate, even though the present prices of sulphuric acid and pyrites should fall. The change is not without its significance, but it must be borne in mind that what may under present internal conditions be a profitable departure in Germany does not infer that it would be an equally profitable policy over here.

Experimental Mine Explosions

THE demonstrations on the explosibility of coal dust in mines, which are being conducted at Eskmeals, Cumberland, under the direction of Professor R. V. Wheeler, head of the experimental station and professor of fuel technology in Sheffield University, are apparently to be continued for some time. It has already been shown that where coal dust is mixed with stone dust the effects of any explosion are greatly reduced, but the limitation of our knowledge is illustrated by the most recent of the experimental explosions. Along the explosion gallery, which is constructed of conical Lancashire boilers, and is 7 ft. 6 in. in diameter, and 750 ft. long, coal dust was laid for about half the length. The explosion was so terrific that part of the gallery was destroyed, and the flame travelled 100 ft. outside the gallery, and was followed by a cloud of dense black smoke. No particular reason for such unexpected results can be assigned, and the incident only emphasises the need of continued research.

In the official report, just issued, on the explosion in February at the Wheldale Colliery, Castleford, some notes by Professor Wheeler on this point occur. Speaking of the analyses of dust samples, he says that the fact was at once apparent that, of the dust collected on the floor, the coarse dust had hardly been affected at all, and the fine dust in but slight degree, by the flame of the explosion, and, therefore, had not participated in the propagation of the flame. This observation was in marked contrast to that regarding the dusts collected from the roof and sides. These, over a considerable length of the face, had clearly been affected by heat; some of them had, in fact, lost as much volatile matter as had several individual crusts of cake that were recovered from props and analysed separately. The explanation of these facts, in Dr. Wheeler's view, is that the fine dust on the floor was weighted down, and prevented from being raised in suspension in the air, by the mass of small coal associated with it. If this view is correct, it would seem that the presence of coarse particles of coal must be regarded, to say the least, as a deterrent of coal dust explosions; and it follows that the effect of mixing coarse dust and small coal with fine dust, as regards the ability of that fine dust to propagate flame, should be closely investigated experimentally. This, of course, is the work on which Professor Wheeler is now engaged.

Disposal of War Stocks

THE report just issued on the disposal of surplus Government property records the progress made in this matter, and explains the reason for the agency agreement entered into with George Cohen, Sons and Co. and Sir W. G. Armstrong, Whitworth and Co. jointly. Quite apart from the selling of surplus property, the Department has had to deal with the clearing of a large number of poison-gas factories, the breaking down of ammunition, and the dumping of dangerous material, such as poison-gas shells which did not admit of being broken down. The greater part of the work in clearing the poison-gas factories has now been completed, and the breaking down and dumping of ammunition, gas shells, etc., will, it is hoped, be completed towards the end of September. In all approximately one million tons of ammunition have been dealt with by breaking down or dumping, and fortunately with very few accidents. The resultant produce from breaking down has been sold on block contracts, and the financial results have been satisfactory. The total sales of chemicals and explosives to March 31, 1923, amounted in value to £28,018,605. Considerable difficulty has been experienced in disposing of cordite, of which very large quantities were surplus at the conclusion of the war. It has been necessary, in view of the cost of storage, the rate of depreciation, and the risk involved in keeping this material, to destroy a considerable portion of the oldest manufactured stocks. As regards the stocks of T.N.T., it has recently been possible to enter into a contract for a block sale at a satisfactory price, but, in view of the large quantity involved and the limited markets, it has been necessary to give storage in magazines for a considerable time.

Chemical Institute for Ireland

AFTER several preliminary meetings a general meeting of chemists resident in Ireland has inaugurated a professional organisation and appointed a committee to put into effect the general purposes of the "Chemical Institute for Ireland." These include the safeguarding of the public by ensuring (1) that all chemical operations in Government laboratories or institutions, or in other laboratories supported wholly or partially by public funds, be under the direct control of a registered professional chemist; (2) that in Irish Courts of Law only registered professional chemists be permitted to give expert chemical evidence in penal cases; (3) that public analysts be registered professional chemists, and that they conform with all requirements of the controlling board in connection with their duties as public analysts; (4) the maintenance of a high standard of efficiency on the part of registered professional chemists.

The committee have drafted regulations for the training of chemists desirous of becoming members of the Institute. The course of training extends over a minimum period of four years, and a register will be kept of chemists qualified to take part in chemistry as applied to industrial, analytical, and agricultural work as well as to research and teaching. It is the intention of the committee to apply to the Government at an early date for formal recognition, by charter or otherwise, of the proposed Chemical Council as the authority for the registration of professional chemists.

Points from Our News Pages

Dr. S. P. Schotz discusses the problems of the production of synthetic camphor (p. 114).
The hearing was begun on Tuesday into a complaint by the Chemical Merchants and Users' National Vigilance Committee that Rochelle salt is improperly included in the list of dutiable articles under Part I. of the Safeguarding Act. The Referee's decision was reserved (p. 118).
Some further notes by Dr. A. D. Risteen are published on the handling of compressed gases (p. 120).
Success is claimed for Claude's method of producing synthetic ammonia from coke-oven gas (p. 121).
Results of research on hydrogen sulphide as an industrial poison are described (p. 124).
Business, according to our London Market Report, still continues on the quiet side, but export demand is slightly better (p. 131).
A slightly busier tone is reported in our Scottish Market Report (p. 134).

Book Received

STANDARD CATALOGUE OF SCIENTIFIC APPARATUS, 1923.—VOL. I., CHEMISTRY. London: Baird and Tatlock (London), Ltd. Pp. 954.

The Calendar

Aug. 11	Mining Institute of Scotland : General Meeting. 3 p.m.	Royal Technical College, George St., Glasgow.
31 to Sept. 22 Sept. 10-13	Shipping, Engineering and Machinery Exhibition.	Olympia, London.
12-19	Institute of Metals: Annual Meeting. British Association for the Advancement of Science: Ninety-first Annual Meeting.	Manchester. Liverpool.

The Production of Synthetic Camphor

By S. P. Schotz, D.Sc., F.I.C.

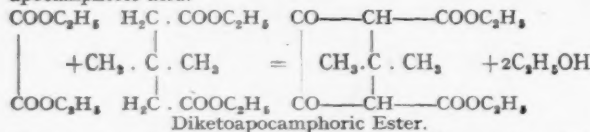
In addition to discussing the details of the production of camphor from pinene, the writer shows how synthetic chemistry has within recent years deprived what used to be the only camphor-producing country in the world of a valuable monopoly.

THE term synthetic chemical can be applied in a very wide and a very narrow sense; strictly speaking, only those organic compounds can be called synthetic which are built up from derivatives having a simpler constitution. In industry, however, such definitions are treated very loosely; we often hear of dextrose as a synthetic material, although it is a degradation product of starch. Similarly, is the synthetic camphor of commerce by no means a substance built up from simpler bodies; but it is either derived from turpentine, which in reality possesses a much more complex structure, or from borneol, isoborneol and their esters, which have a larger molecule than camphor. Really only a camphor prepared by the methods of Komppa or Perkin and Thorpe could be called synthetic camphor. However, at present, apart from the natural, a substance derived from turpentine is the only product on the market and *volens volens* one has got to adhere to this description. Even when one would like to give it the more suitable name of artificial camphor, one finds the way blocked by pinene hydrochloride, a substance very distinct from camphor but reminding one of it by appearance and smell, to which the name artificial camphor has been given many years ago when the nature of these substances was imperfectly understood.

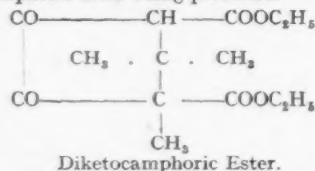
Let us review briefly the work of Komppa and Perkin and Thorpe, not only on account of the very interesting reactions involved, but also in view of the possibility that one of the many intermediate substances which figured in these syntheses might at a future date be easily accessible and therefore permit the commercial exploitation of the ingenious ideas of these scientists.

Komppa's Synthesis

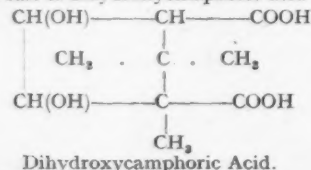
Oxalic ester and $\beta\beta$ -dimethyl-glutaric ester are condensed with the aid of sodium ethoxide producing the ester of diketapocamphoric acid.



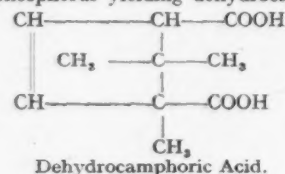
The ester was then methylated by means of sodium and methyl iodide diketocamphoric ester being produced.



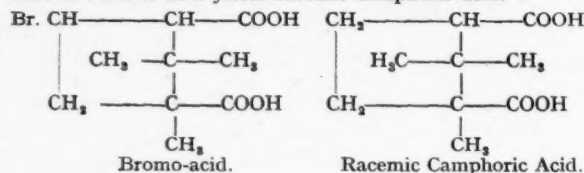
This was then dissolved in soda solution and treated with sodium amalgam in an atmosphere of carbon dioxide. The two carbonyl groups were reduced by the nascent hydrogen and the sodium salt of dihydroxycamphoric acid was obtained.



This compound is then boiled with a mixture of hydriodic acid and red phosphorus yielding dehydrocamphoric acid.

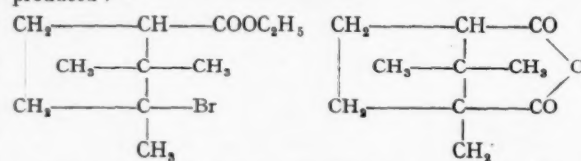


On heating with hydrobromic acid in acetic acid solution at 125° C. a bromo-acid is obtained, which on reduction with zinc dust and acetic acid yields racemic camphoric acid.

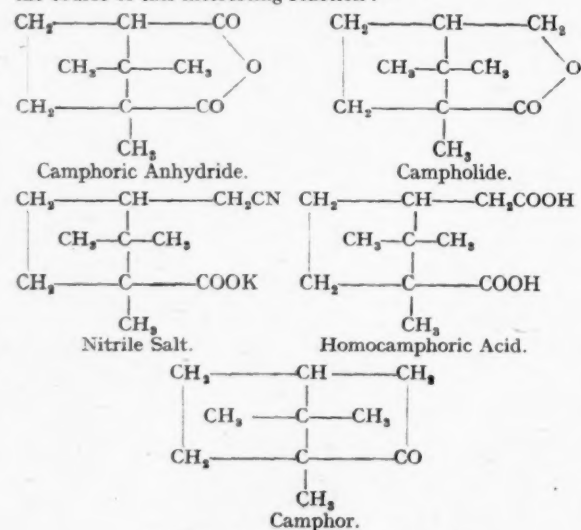


The Synthesis of Perkin and Thorpe

Trimethyl-1, 2, 2-bromo-1-cyclopentane carboxylic ester is shaken with a mixture of potassium cyanide and hydrocyanic acid solutions and the product heated and finally boiled with acetic anhydride. Racemic camphoric anhydride is thus produced:—



The final stages of both syntheses are the same and have been established long before camphoric acid had been synthesised. The camphoric acid is converted into camphoric anhydride, which is reduced to campholide by means of sodium amalgam; this on treatment with potassium cyanide yields a nitrile salt, from which homocamphoric acid is obtained on hydrolysis. The acid is converted into its lead or calcium salt which on distillation give camphor. The following formulæ demonstrate the course of this interesting reaction:—

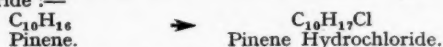


Technical Synthesis of Camphor

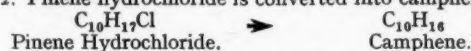
The only processes which have proved of value in commerce start from pinene, which is the principal component of American oil of turpentine. The best turpentine for the purpose is prepared by steam distilling crude colophony, and when properly made consists of almost pure pinene. The so-called Russian and Galician oils of turpentine are usually prepared by dry distillation of roots of conifera, and contain far less pinene and are not so suitable as the American, French, etc. The oil is best when freshly distilled; on prolonged standing in presence of air turpentine becomes altered through oxidation and turns acid; these acids must be removed before distillation is carried out. It boils between 150° and 165° C.

The following series of reactions gives a picture of the various links in the chain from pinene to camphor.

1. Oil of turpentine is treated with HCl gas yielding pinene hydrochloride :—



2. Pinene hydrochloride is converted into camphene :—



3. Camphene on treatment with acids gives a mixture of esters of borneol and isoborneol.

4. These esters are either oxidised directly to camphor or saponified.

5. The borneol and isoborneol thus obtained are transformed into camphor :—



Camphene may be oxidised straightway to camphor.

Another method which appears to find a great deal of favour in industry differs from the above insofar that camphene is first converted into isobornyl ester which is then converted into isoborneol, this being finally transformed into camphor.

A third method deviates from the previous ones inasmuch that no camphene is isolated, but pinene hydrochloride is directly transformed into isobornyl ester.

A direct method of conversion of pinene into a mixture of esters of borneol and isoborneol has also met with a great measure of success.

We shall now consider in detail some of these processes, giving wherever possible the more reliable information which is available regarding the actual manufacture.

The first process which we have discussed has been the subject of an immense amount of work, the various stages have been studied in very great detail, both from the purely scientific and technical points of view, and a number of valuable patents deal with the improvements connected with these. Although this process has a comparatively long series of stages, still it is very good owing to the ease with which the series of substances can be prepared.

Pinene Hydrochloride

This substance was first prepared by Kind in 1803. It is made by passing dry HCl gas into perfectly dry, well-cooled turpentine which has been freshly distilled and carefully fractionated. If the mixture is not properly cooled or moisture is present a dihydrochloride is formed (dipentene dihydrochloride). The mixture must be thoroughly agitated, otherwise, even with the best cooling local overheating cannot be avoided.

When the oil has been thoroughly saturated with hydrochloric acid, it is converted into a mass of white crystals of the hydrochloride. This mixture is filtered by means of a vacuum filter, when pinene hydrochloride is obtained. The material thus produced contains small quantities of various impurities which are easiest to remove at this stage. Various methods have been proposed to this end. It is beyond the scope of this article to go into details of these methods, which will be dealt with at length elsewhere. In every case the pinene hydrochloride is steam distilled and then fractionated. The residues which are obtained are treated separately when sufficient has accumulated. All this appears to be highly complicated, yet in a well-organised works such a process is really quite simple. Pure pinene hydrochloride is a crystalline substance melting at 125° C. and boiling at 207°–208° C. without decomposition; its specific rotation varies considerably with the character of the oil of turpentine from which it has been prepared. The chlorine atom is firmly bound to the pinene complex; even boiling solutions of caustic alkali do not split off HCl from the complex.

Manufacture of Camphene

Although camphene cannot be obtained from pinene hydrochloride by the action of aqueous alkalis, yet if anhydrous alkalis or alkaline earths hydrates are applied, HCl is easily removed. This method forms the subject of several interesting patents, the main idea being the same in every case. For example, pinene hydrochloride is heated in definite proportions with slaked lime to 130°–160° C.; the yield is said to be above 90 per cent. Another patent recommends the addition of substances like glycerine, dextrine or starch; the function of

these substances is not only to dilute the pinene hydrochloride but also to weaken the effect of the excess of alkali on the very delicate camphene which is formed. The moderating effect of soaps of the higher fatty acids has also been tried and found very useful, although in this case the reaction has to be carried out at 210°–220° C., and therefore necessitates an autoclave. By far the best method is probably that of Reyckler. The usual procedure of his invention is to heat a mixture of pinene hydrochloride with phenol or cresol to which caustic soda is added in a quantity insufficient to bind more than about half the phenolic body; the mass is heated in an autoclave to about 160° C. for ten to twelve hours. To the product sufficient caustic alkali is added to combine with the liberated phenol, and the mixture is then steam distilled. No doubt the greatest difficulty of all these processes consists in avoiding decomposition or alteration of the character of camphene, and it is instructive to see to what skilful devices recourse has been taken to overcome this. In a technical process such a little change often means all the difference between failure and success.

In the mind of an inventor chemical compounds are not merely what we see in the dead formulæ of a text-book of chemistry. During constant work and thought properties are discovered which may be quite unimportant but are extremely valuable for a definite commercial purpose. In going over the various methods which have been suggested for the manufacture of camphene the reader will find ample proof of this general proposition. In most text-books of organic chemistry it is pointed out that the nitrophenols have higher acidic properties than phenol because they decompose sodium carbonate, while phenol, it is stated, is without effect on this substance; but it has been found that phenol *does* decompose sodium carbonate, only the reaction occurs at very high temperatures. Accordingly a method has been patented by Skita in which soda, phenol and pinene hydrochloride are heated to about 160° C. for a few hours; the caustic soda produced at that temperature enters into reaction and gives camphene in yields which are claimed to amount to 97 per cent.

Mixtures of zinc oxide and caustic soda have also been utilised very successfully for the same purpose. By whichever method camphene is prepared it has to be purified, and this can be done by means of steam distillation, fractionation, etc.

Conversion into Borneol and Isoborneol

This is usually effected by way of the acetic esters of these alcohols. The procedure is in general to treat camphene with acetic acid in presence of sulphuric acid, a mixture of esters being produced. As in the case of ordinary esterification, numerous ideas have been successfully tried. So, for example, sulphuric acid has been replaced by phosphoric anhydride.

The whole matter is a question of cost of re-agents and organisation; one material may be more suitable for one works than for another. Camphene can also be directly converted into isoborneol by treating it with concentrated pure toluenesulphonic acid at 20° C.

Preparation of Camphor

The esters of borneol and isoborneol are hydrolysed by any of the usual methods, and then oxidised to camphor by means of dilute chromic acid mixture. The low price of natural camphor makes it imperative to reduce wherever possible the cost of reagents in the production of the synthetic compound. The oxidation of borneol and isoborneol appears to be a case where expensive reagents can be done away with. Numerous attempts have been made to utilise atmospheric oxygen in the form of air, oxygen and ozone, and although, for the present, the experiments have not been entirely satisfactory, there cannot be the least doubt that this method will finally be dealt with in a successful manner. Apart from anything else, in order to be successful, a method for oxidising borneol and isoborneol must satisfy the following requirements :—

- (1) The yield of camphor must be very high in a single operation.
- (2) No appreciable quantity should be burned.
- (3) Little, if any, by-products should be formed.
- (4) The camphor produced must be easily recoverable; not more than a minimum proportion should be carried away by the waste air. Owing to the high volatility of camphor this point is very important. We will now consider the practical execution of one or two of the methods which have been

suggested, and the reader will be able to judge for himself how far these processes are likely to satisfy the specified requirements of an ideal procedure.

Oxidation by Means of Air

(1) 300 litres of oxygen are passed over one kilogram of isoborneol at 160° C. The mixture of gas and vapours is cooled; there is a 20 per cent. formation of camphor with a loss of 1 per cent due to oxidation. If air is used instead of oxygen only 6 per cent. of camphor are formed.

(2) A further method consists in passing a mixture of borneol and isoborneol with air over carbon heated between 150° and 300° C. This method probably suffers from all the defects which are inherent in the first method we described. Electrolytic oxidation has also been patented by a number of inventors. One of the drawbacks in this case is the insolubility of these substances in aqueous solutions. Further, the work is generally carried out in a medium containing compounds of manganese and chromium. There can be little doubt that these metallic compounds do not act merely as catalysts, but are the actual oxidising agents, the electric current serving to regenerate the active form of these compounds.

The work of Sabatier and Sonderens has proved a great stimulus for substituting, wherever possible, catalytic reactions for purely chemical ones; as these discoverers have catalytically converted alcohols into aldehydes and ketones it was quite logical to apply the same reactions to derivatives of camphor. In the first place, the reaction was carried out in an identical manner, as it was done originally by the French investigators—namely, by passing isoborneol in the form of its vapours over finely divided copper. Later on, processes have been discovered in which the procedure was much more original; so, for example, five parts of isoborneol are mixed with one part of xylene, and while heated to an elevated temperature, mixed with one part of powdered nickel, and when the reaction slackens more powdered nickel added. A similar mode of action has been recommended for borneol, the yield by this reaction is 95 per cent. of camphor. It is quite obvious that it is very uneconomical, owing to the high proportion of nickel employed and also the amount of labour and supervision which it necessarily entails.

Another method is based on catalytic dehydrogenation by means of nickel and sodium hydroxide, which have been produced by mixing solutions of pure nickel nitrate and caustic soda, evaporating to dryness, calcination and reduction by means of hydrogen. When the powdered material is introduced into fused borneol, a strong evolution of hydrogen occurs. A study of the recent work on catalytic hydrogenation makes us believe that this method or one of its future modifications may prove the cheapest and most efficient way of converting borneol and isoborneol into camphor.

The esters can also be directly oxidised to camphor. The camphor is subsequently subjected to a chemical treatment and finally fractionated or sublimed.

Direct Production of Camphor

This has been the subject of numerous patents. According to Kingzett and Ziegler turpentine oxidised with air in presence of water is transformed into camphor. Horne has attempted to obtain the same result by treatment of turpentine with ozone. Le Roy treats turpentine with chlorine and the resulting product with a metallic hydroxide. The yield of camphor by all these methods appears to be very small, and they do not appear to have met with any success as far as commercial application goes. The inherent idea is quite reasonable.

Far greater success has followed the attempts of direct preparation of borneol and isoborneol from turpentine. On treatment with oxalic acid pinene yields about 25 to 30 per cent. of borneol in the form of esters. The addition of catalysts aids to increase the yield. A further advantage is stated to be obtained by diluting the reaction mixture. Oxalic acid has been made use of for the production of camphor and borneol from pinene in a different manner as well. The procedure consists in heating a mixture of pinene with anhydrous oxalic acid in vacuo at about 125° C. A reaction occurs, camphor, borneol and various esters being formed. According to the inventor, pinyl oxalate is one of the primary products, and this, on heating, gives camphor. At the same time pinyl

formate is obtained by way of formic acid produced from oxalic acid, and this ester on heating is transformed into borneol.*

When the reaction has been completed the excess of acid is removed and the camphor isolated by fractionation and freezing. The residual oil is hydrolysed with alkali, when a further quantity of camphor and borneol is obtained in a similar complex manner. The yield of camphor is stated to be 100 parts for every 350 parts of turpentine.

Chlorobenzoic acid has also been successfully employed for the direct production of esters of borneol from pinene. The final yield of camphor which is obtained by this method is said to be 28 parts per hundred parts of turpentine.

The synthetic camphor of commerce is as a rule optically inactive. It contains, as impurities, small quantities of materials which are intermediates in the manufacture, such as camphene, borneol and isoborneol, and very frequently traces of chlorine. The elimination of the last impurity is of great importance to certain industries.

Economies of Synthetic Camphor

Theoretically one hundred parts of pinene ought to yield about one hundred and twelve parts of camphor. In practice the yields are very much smaller quite independently of the larger or smaller number of stages in which camphor has been manufactured. With the present average prices of turpentine and camphor the manufacture of the synthetic material would be quite an unprofitable proposition in this country. Where, however, a cheap supply of turpentine is available, or a cheap brand of somewhat inferior turpentine can be obtained, the manufacture of synthetic camphor would prove a great asset. We must not forget in discussing this question that the by-products, all of which could be completely recovered, would have the same value for the making of paints and varnishes, while some components would prove useful for the production of essential oils. The manufacture would be best carried out in connection with an essential oil works. These considerations must not lead the reader to treat the question of synthetic camphor in a light manner. Natural camphor was a monopoly of Japan practically up to 1902, and the price of this material continued to rise to many times its actual value. The production of synthetic camphor has compelled the reduction of price to a competitive level. Thus chemistry has once more provided a weapon for counterbalancing the natural advantages of one country over the rest of the world.

Defence of the Dyestuffs Licensing System

IN the House of Commons on Thursday, July 26, in the course of a debate on British trade, Mr. H. Spencer (Bradford) said the Board of Trade did not seem to realise the importance of the dyeing trade. The difficulties put in its way might lead to its being lost and the textile trade being much hampered.

Sir T. Robinson (Stretford), who is chairman of the Licensing Committee, said that the Act establishing the prohibition of the import of dyes was unanimously approved by the colour users, and, on the guarantee of prohibition for ten years, £10,000,000 of public money had been advanced to the dye industry. Ninety-four per cent. of the applications for licences to import dyes were dealt with within four days, and 62 per cent. were actually dealt with on the day they were received. Very few complaints were made, although people sometimes felt aggrieved when they could not import job lots of dyes. The manufacture of British dyes could not have succeeded without prohibition, and the industry was daily nearing the time when British dyes would produce the largest volume of colour of the best quality at the lowest price. He asked the House not to believe fairy stories which came in letters to members.

Lieut.-Colonel Astbury (Salford) stated that on the production of 150 yards of cloth the total cost of the dye was only 3 per cent. of the value. It was absurd to say that this licensing was ruining our textile industry. If there was no licensing whatever the cost of printing and dyeing cloth would not come down.

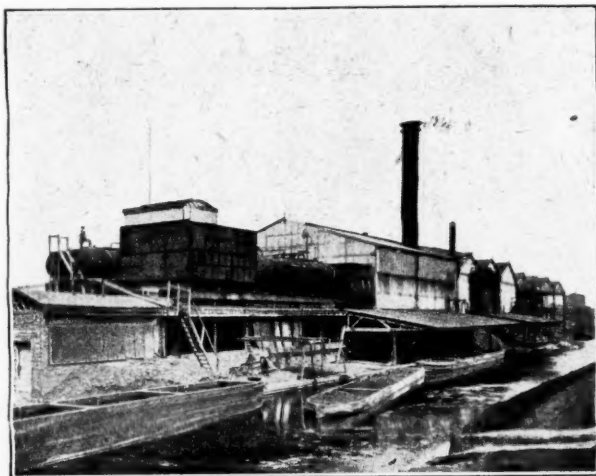
* It is only proper to state here that although pinyl formate and oxalate are described in the patent as definite substances, this view has met with considerable criticism and the opinion has been expressed that they are merely mixtures.

The British Cyanides Co., Ltd.

The Problem of Raw Material

THE history of the British Cyanides Co., Ltd., consists of a continuous struggle for unlimited raw material at a low cost. The main source of supply has been from gasworks in the form of sulphocyanide, under the Williams patent owned by the company.

This source of raw material has recently been supplemented by a contract entered into over a period for the supply of



POPE'S LANE WORKS.

cyanogen in another form, but this side of the company's business will not be permanently unassailable until unlimited supplies of cyanogen can be drawn cheaply from the nitrogen of the atmosphere. Very large sums of money have been spent by the company on this problem, the solution of which now appears to be within sight.

Concurrently with experiments on this main problem of raw material, research work has been constantly carried out with the object of manufacturing the raw material available into those products which are the most remunerative. The war upset all calculations in this respect, but the work has been fully justified by results, and new avenues in several directions have been opened up for fuller development as raw material becomes available.

Potash Supplies

During the war the importance of native supplies of potash was brought home forcibly to this and other countries where such supplies were lacking, and a new source of raw material was discovered by the British Cyanides Co. in co-operation with the North Lincolnshire Iron Co., Ltd., in the dust recovered from blast furnace gases. This development is one which is likely to be invaluable in the future to any highly industrialised community in the event of conditions arising similar to those ruling during the war, but in normal times the process holds out little prospect, except in certain limited directions, of being able to withstand the competition of the potash mines of Germany and Alsace. In spite of this, there are opportunities in this country for the manufacture of a number of potash chemicals, and the knowledge and experience gained during the war by the company, supplemented by active research work ever since, has opened up a field of activity which is becoming fruitful as its cultivation develops.

Works Equipment

The chemicals manufactured by the company all involve the evaporation of liquids for subsequent crystallisation, and this factor has determined the method of producing power at each factory. Actually, the electric current generated as motive power for the various factories is a by-product

of the heat required for concentrating the various chemicals in solution. At each factory, boiler plant, power plant, and plant for evaporation under vacuum have been installed adjoining one another. In the power house at Pope's Lane Works, the various engines (for generating current, compressing air and the like) exhaust at a back pressure that can be varied at will from atmospheric pressure up to 15 lbs. per square ft. into a Kestner evaporator plant situated at the end of the building. Here the steam is condensed and returned as distilled hot water to the boilers, while chemicals in solution are concentrated and run to the crystallising plant. Each factory has a similar plant, and all the generators are synchronised so that the power load of all three factories can be borne by any one factory to the extent required by that factory to suit the quantity of liquor to be crystallised. In practice, this works smoothly and has brought about very great economies in manufacturing cost. Steam required in the various processes is drawn from the high pressure main at a high degree of superheat. The efficiency of this system has amply justified the capital expenditure on its installation.

Laboratories for Research Work

In the manufacture of chemicals, perhaps more than in any other branch of industry, development must be unceasing; and the keynote of such development is research. Many are already aware that through its subsidiary, the Oldbury S.C. Syndicate, Ltd., this company has spent a very large sum of money on the problem of the fixation of atmospheric nitrogen. The Oldbury S.C. Syndicate, Ltd., has erected a large building solely for experimental work on this problem and equipped it with plant for handling many tons a day. Apart from this, a whole wing of the office building is given up to two laboratories, one of which is illustrated. This laboratory, which is used for analytical work, is supplemented by a second laboratory immediately underneath, fitted with machinery and plant for large scale laboratory experiments.

There is now, in addition, a building in the works close to the laboratories, which is fully equipped for experiments on a small works scale. In this building is a unit of practically every type of plant used for chemical operations throughout



RESEARCH LABORATORY.

the factory. This recent addition to the resources of the company has already fully demonstrated its value as a nursery for new developments. Since the commencement of the year the Tat Bank Factory has been reopened to operate one new process, the plant for a second is now in course of erection, and the research work which this company has carried through during the difficult times that have been experienced since the war should result from now onwards in further rapid expansion of the company's business.

The Safeguarding of Industries Act

Rochelle Salt Inquiry Opened

A COMPLAINT by the Chemical Merchants and Users' National Vigilance Committee that Rochelle salt has been improperly included in the list of dutiable articles under Part I. of the Safeguarding of Industries Act was considered on Tuesday, July 31, by Mr. Cyril Atkinson, K.C., the Referee. The complainants were represented by Mr. Kenneth Swan and Mr. R. Lambert Parry; the opponents, Howard and Sons, Ltd., and May and Baker, Ltd., were represented by Sir Arthur Colefax, K.C., and Mr. Stafford Cripps; whilst the Board of Trade, who were, as usual, associated with the opponents, were represented by Mr. Trevor Watson.

The Complainants' Case

MR. KENNETH SWAN, for the complainants, said that according to the statement put in by the Board of Trade, Rochelle salt had been included in the list of dutiable articles on the ground that it was a fine chemical and also an analytical reagent. Fortunately there was no question, in this instance, of synthesis. There was a close relation between Rochelle salt and cream of tartar and tartaric acid, and if the Rochelle salt case had been heard at the same time as the cream of tartar case, he did not think there would have been much difficulty in disposing of it on similar lines, when the Referee held that cream of tartar and tartaric acid were heavy chemicals. Rochelle salt appeared in the list of dutiable articles under that head and also under the headings of sodium potassium tartrate and potassium sodium tartrate, and his case was that it should come out of the List under all three headings, the three names referring to the same substance.

When tartaric acid was dealt with by the Referee, two processes of making tartaric acid and cream of tartar were discussed. One was that referred to as the St. Thibery process, in which argol was treated with calcium carbonate, and the other was known as the Rochelle salt process, in which they proceeded, via Rochelle salt, to obtain tartaric acid and cream of tartar. In that case the argol was treated with sodium carbonate. The evidence had shown that the French manufacturers, for the most part, used the St. Thibery process, although there was one works where the Rochelle salt process was used. The English manufacturers had pressed upon the Referee that their manufacture of tartaric acid and cream of tartar via Rochelle salt was fine chemical manufacture, the reason being that Rochelle salt was much more soluble than cream of tartar, and that the process could be carried on either with smaller vats or a smaller number. Apart from the very large use of Rochelle salt as an intermediate body in the manufacture of tartaric acid, which ran into hundreds or thousands of tons, the other uses of Rochelle salt were extremely small, in comparison. It might be said that there was only one substantial use, namely, in the preparation of the health salt known as the Seidlitz powder. Some years before the war the importation of Rochelle salt was restricted by a trade arrangement between the manufacturers here and the potential importers abroad, so that there had been an artificial restriction of the importation of Rochelle salt into this country. He was quite prepared to make the admission that the importation of Rochelle salt into this country, as a result of the arrangement to which he had referred, was a negligible quantity at present, but it was a commodity very largely used wherever tartaric acid, cream of tartar, and tartrates were manufactured, both in this country and abroad, and it could not be contested that that was the main use of Rochelle salt.

The Referee would see in this case more markedly than in any other he had heard that there was a very small amount of trade usage, owing to the fact that there had been practically no importation into this country for some years past. It had been sold in Seidlitz powders, in small quantities, and there had been no market quotations such as in the case of tartaric acid or cream of tartar. It was produced every day in this country by Kemball Bishop and Co.

THE REFEREE said that if this were a doubtful borderline case, it ought to come out of the list.

MR. SWAN agreed, unless the Board of Trade were able to satisfy him on this point by primary evidence.

Mr. Parry's Evidence

MR. E. PARRY (analytical chemist) was the only witness called for the complainants. Tartaric acid, he said, was a body conveniently referred to by the expression T, as meaning the tartaric molecule, the two atoms of hydrogen. If one of these atoms be replaced by potassium, they obtained cream of tartar, and if both were replaced by potassium, they obtained neutral tartrate of potash, but if one were replaced by sodium and one by potassium, they had Rochelle salts. Asked at what stage of the manufacture of tartaric acid the Rochelle salt was produced, he said that for purposes of purification it was probably produced from the finished cream of tartar as a commercial article. He had never heard or seen Rochelle salts described as a fine chemical anywhere, although he had searched literature. It was very rarely quoted in trade reports, but when it was, it was more often than not reported as a pharmaceutical chemical. A number of trade catalogues were then put in to substantiate this. R. W. Greeff's catalogue of 1913 had a heading "Fine Chemicals and Pharmaceutical Preparations," but he did not find Rochelle salt under that heading. Under "Technical Chemicals" he found Rochelle salt as such, tartrate of soda, sold in 5 cwt. casks. In a price list issued by Sparks, White and Co., Rochelle salt was not quoted under "Fine Chemicals," but under "General Chemicals."

The witness referred to a list of British research chemicals, drawn up by the Association of British Chemical Manufacturers. In the introductory note it was stated that the Association wished to make an appeal to all research chemists in this country on behalf of the fine chemical industry. He would not expect to find Rochelle salt here, because it did not come under the category of research chemicals. This was a preliminary list, and a supplementary list was issued in March, 1922, and entitled "Some British Fine Chemicals Produced by Members of the Association." It contained some 2,000 fine chemicals, but did not include Rochelle salt, although sodium tartrate and potassium tartrate—the neutral tartrates—were there.

In this country, witness said, Rochelle salt was manufactured principally by Howards and May and Baker, and the former firm made both heavy and fine chemicals. They had a special branch, under the name of Hopkins and Williams, which was their fine chemical branch, and their product commanded a higher price than that of other firms owing to its high purity. Rochelle salt was made by one or two exclusive firms, and was used almost entirely for Seidlitz powders, etc.

THE REFEREE: So that, for its real use, it never comes on to the market at all?

MR. PARRY said it was not dealt with on the market and speculated in, as were many other chemicals, but almost invariably went straight from manufacturer to user. Over 95 per cent. of the Rochelle salt of commerce was used for preparing health salts, etc.

Asked whether there could ever be a question of importing Rochelle salt for the manufacture of cream of tartar, the witness said that he could not conceive of its being imported—if it were imported—except to sell direct to the manufacturer of Seidlitz powders, etc.

With regard to purity, the British Pharmacopœia required a purity of not less than 98 per cent. As to its use as an analytical reagent, this was entirely a question of degree, and, so far as he knew, it was used substantially for only two purposes in this connection. The first was for the determination of small quantities of sugar, when it was used in the form of Fehling's solution—he used the word "small" to distinguish this from the very large amount of analysis of crude sugar, which was carried out by a quite different method. The second use was for the determination of quinine. It was included in the list of substances and reagents for testing in the B.P., and in Merck's book, under the heading of "Chemicals and Reagents Employed in Chemical Testing." Under that heading, Rochelle salt appeared as sodium potassium tartrate. It appeared in the same category as did distilled water, as an article employed in chemical testing.

Asked whether chemical testing meant the same thing as analytical reagency, the witness said that for chemical testing they would include practically every chemical. Sugar and starch were used for chemical testing, but he did not think they could be classed as analytical reagents.

Reference was then made to other lists of reagents in which Rochelle salt does not appear, including the list prepared a few years ago by the Joint Committee of the Institute of Chemistry and the Society of Public Analysts.

MR. PARRY, answering the Referee, agreed that Rochelle salt had a definite, though he would not say substantial, use as an analytical reagent, if its use in Fehling's solution were included. By itself, it was not used to any great extent as a reagent, although it was used for the determination of quinine. He also agreed with the Referee that if a substance has a real and regular use as a reagent, the fact that it has also a substantial use for other purposes should not necessarily exclude it from the category of reagents.

SIR ARTHUR COLEFAX, in the course of his cross-examination, put it that Rochelle salt is as largely used as a great many other analytical reagents, and in addition to the uses already mentioned, he added the estimation of aldehydes and antimony, although Mr. Parry said that these other uses were infinitesimal. His general view was that it was difficult to regard Rochelle salt in any other way than they regarded cream of tartar and tartaric acid, which it had been decided were heavy chemicals.

Later, the REFEE said he thought it was difficult to say why Rochelle salt should not be classified as a reagent, and Mr. Swan dealt with this point.

MR. TREVOR WATSON, for the Board of Trade, argued that there could be no question that Rochelle salt was properly described as an analytical reagent.

Expert Evidence in Opposition

Evidence was called by Sir Arthur Colefax, in opposition to the complaint.

MR. DAVID LLOYD HOWARD, managing director of Howard and Sons, Ltd., said that Rochelle salt was known in the trade as a fine chemical and it was also well known as an analytical reagent. He regarded it as a fine chemical on account of its high degree of purity and the skill required in its manufacture. It was necessary to have skilled supervision at every stage. Coupled with this was the large use of Rochelle salt in pharmacy, which also brought it within the category of fine chemicals in his opinion. Cross examined, the witness said his firm employed four or five skilled chemists as well as four skilled chemists on the board. There were also junior chemists in the works. The works managers supervised the works operations and the chemists looked after the analytical work. One of the qualified chemists looked after the analytical work in connection with Rochelle salt.

MR. P. BLENKINSOP, director of May and Baker, Ltd., the second largest manufacturers of Rochelle salt—Howard and Sons being the other—in this country, gave similar evidence. The manufacturers had always looked upon Rochelle salt as a fine chemical, and he had never known it regarded in any other way.

MR. HAROLD STEVENS, director of John Bell, Hills and Lucas, Ltd., wholesale druggists of Tower Bridge Road, London, said his firm bought Rochelle salt from the manufacturers and had always treated it as a fine chemical. It was also used in their works as an analytical reagent, and sold for that purpose in the form of Fehling's solution. In regarding Rochelle salt as a fine chemical, he went solely upon its high degree of purity.

MR. EDMUND WHITE, managing director of Hopkins and Williams, Ltd., the fine chemical branch of Howard and Sons, spoke specially with regard to the use of Rochelle salt as an analytical reagent in Fehling's solution, and said it was universally used as such in all educational and analytical laboratories. Answering the Referee, the witness said he regarded Rochelle salt as a fine chemical on account of the skill required in manufacture and also by reason of the high degree of purity demanded. His opinion was that the use of Rochelle salt in Fehling's solution was just as clear and definite a use as a reagent as if it were used alone. Without Rochelle salt, Fehling's solution would be no good at all.

The Referee will consider his decision.

A New Ash-Handling Plant

THERE is now being installed at the St. Pancras Electricity Station, by the Underfeed Stoker Co., Ltd., of London, an ash conveyor on the water sluice principle, which promises to effect considerable advances in ash conveying. The mechanical conveying of ash and clinker is one of the most unsatisfactory operations in the field of power generation, because of the hard and abrasive character of the material, and particularly because of corrosion, so that the wear and tear and depreciation on any ordinary ash conveyor is extremely severe—for example, at least three or four times as great as that of coal conveying. The boiler plant under consideration consists at present of two water-tube boilers of 40,000 lb. evaporation each, and two other boilers now in course of erection, forming one line of four boilers. The ash and clinker drops over the end of the stokers, totally enclosed, into heavy cast-iron ash hoppers, which dip into an entirely enclosed concrete trough underneath forming the water sluice. This trough is semi-circular in section, with an internal width of about 1 ft. 6 in. and a depth of about 2 ft. 6 in., and runs underneath the boilers common to all the ash hoppers. Rushing along inside this trough is a volume of water at a constant depth of about 6 in., with a flow volume of 600 gallons per minute, which passes into a large underground concrete ash discharge pit.

In the near future another row of four 40,000 lb. boilers will be erected, which will be served by a similar trough, and both troughs are equipped with one main pumping installation, which pumps the sluice water from the ash discharge pit, passes it to the other end of the troughs, along which it flows to the pit again, forming a completely closed circuit with a very rapid flow of water. The power required for the whole eight boilers will only be one centrifugal pump of 16 h.p., running at 936 revs. per minute, with a total flow of water in the closed circuit of 1,200 gallons per minute, so that the power required is infinitesimal. The red-hot ash and clinker drops into the flowing water, is quenched at once, and swept along and discharged into a large concrete tank, where it falls to the bottom, the water passing back to the centrifugal pump through strainers. As the ash and clinker accumulates it is removed from time to time by a large telfer grab, and the whole system is extremely simple, neat and efficient. In addition to the small power required, there is also a number of other advantages, chief of which is the almost entire absence of wear and tear, since there is nothing to go wrong. Also the whole arrangement is totally enclosed, so that there is no dust and dirt, no heat, and particularly no escape of foul-smelling steam, whilst the ash and clinker, as soon as it falls into the comparatively cold water, at once breaks up into small pieces. Another curious fact is that in the presence of a large bulk of water in this way the material is alkaline in spite of the fact that ash and clinker when quenched with a small amount of water in the ordinary way is distinctly acid. The amount of make-up water required in the total circuit is very small, and the temperature does not rise much above 140° F.

The Real Situation in Europe

At the situation now stands, optimism and goodwill are needed where the future of Europe is concerned as they were never needed before. For that reason we regret (says the *European Commercial*) to note that a London daily paper, in a leading article on Mr. Baldwin's statement, remarks that "the European economic system with which all our civilisation is interlocked is slowly and steadily sinking." To the casual observer such might possibly appear to be the case, but, to those who care to probe deeper into the heart of things, it is manifest that such a statement is erroneous. The truth of the matter is, of course, that the European economic system is not sinking at all. Its development, it is true, has been badly interfered with by the Ruhr trouble, which has made itself felt in trading circles all over the Continent. But we hold by the belief that Europe as a whole is not going down, but up. Those who take the opposite view have clearly been deceived by the slower rate of progress which its development, hampered by recent events, has made. The present negotiations will then, if they are successful, not save a demoralised Europe from the abyss of despair into which it is falling, but remove the obstacles in the path of a development which is being cruelly hindered.

Further Notes on Handling Compressed Gases

In our issue of June 2 we published, under the heading "Notes on the Handling of Compressed Gases," some sections of a paper by Dr. A. D. Risteen given before a joint meeting of the American Society of Safety Engineers and the Safety Codes Committee of the American Society of Mechanical Engineers. We now give sections on acetylene, ammonia, and chlorine.

Acetylene

No person should ever undertake to compress acetylene unless he fully understands the properties of the gas and knows exactly what it is permissible to do and what he must carefully avoid doing. This is not meant to imply that the compression of acetylene is a dangerous operation when it is performed under the direction of a properly qualified man, but it is intended as a special note of warning to those who are tempted to compress the gas without first understanding its properties. Acetylene is an endothermic compound, and this formidable word has frightened a great many persons who do not understand its exact significance. It merely means that heat is absorbed (instead of emitted) when acetylene is formed from its constituent elements. Now it is well known that substances of this kind are likely to be more or less unstable under certain conditions, and acetylene is no exception to the rule; but the conditions under which the instability exists are well known, and it is only the man who does not understand them, or who is pleased to ignore them, who gets into trouble.

In compressing acetylene it is important to keep the temperature of the gas as low as practicable at all times. Expressed in more definite language, this means that the compression must be effected by a pump moving with a very low piston speed, and that it must be performed in not less than three stages. It also means that the pump cylinders should be kept as cool as practicable by a plentiful supply of water drawn from the coolest available source. The author cannot state any definite temperature at which the gas may become unstable during the act of compression, and in fact it is doubted if anyone knows what that temperature might be. The only thing that we can say is, that if the operation is conducted as here described, there is apparently no danger from instability. It certainly is not safe, however, to store acetylene in otherwise empty cylinders, at the pressure at which the compressor pumps deliver it.

There appears to be a time element involved here, and it is probable that a certain amount of polymerization gradually occurs in strongly compressed acetylene (except when it is stored in special receptacles containing suitable porous material charged with liquid acetone), so that in the course of time, small quantities of other more sensitive substances are formed, which serve to lessen the stability. At all events, we know that acetylene should not be stored in an otherwise empty tank at a pressure of more than 15 lb. per sq. in. greater than the normal pressure of the atmosphere, and yet we know that explosions in the compression pumps, and in the delivery pipes leading from them, are exceedingly rare if the compression is effected as here described. In fact, the author knows of only one case of the sort, and this was precipitated by the breakage of a steel valve spring, which quite possibly struck a spark and thereby caused the development of a high temperature within the tiny space filled by the spark itself.

Oil may be used for lubricating the cylinders of acetylene-compressing pumps, but it should afterwards be removed by passing the compressed gas through suitable separators as it leaves the compressor. And immediately upon leaving the oil separator the acetylene should be passed into the storage cylinders, which, as previously stated, must be filled with a special porous, solid material thoroughly impregnated by liquid acetone, which dissolves the acetylene and holds it safely in solution.

It should not be necessary to issue a warning against mixing other gases with acetylene in the storage tanks or using acetylene storage cylinders for any purpose whatsoever, except for holding pure, unmixed acetylene (in addition to the safety filling).

Ammonia

Liquefied ammonia is used in immense quantities in connection with refrigerating machinery, and although it perhaps cannot be called a poisonous gas in the narrow sense of the term, it is easily capable of producing unconsciousness and death when it is present in the air in any considerable amount. Similar remarks apply to sulphur dioxide gas, which is also

used in refrigerating machinery as well as in various other applications. Both of these gases are freely soluble in water, and it is recommended that in all rooms in which they are handled an overhead sprinkling system be provided that is capable of discharging large volumes of water into the room in case of the accidental liberation of excessive quantities of either gas. A considerable part of the liberated gas would be absorbed by the down-rushing water, and even though the air might not be rendered respirable in this way, something would surely be gained in the way of checking the spread of the gas to other rooms. It is certainly important to provide free and abundant ventilation in and adequate means for quick exit from any room in which either gas may suddenly be liberated in quantity. These simple and evident precautions are often wholly disregarded in laying out plants in which ammonia or sulphur dioxide are handled or used.

Ammonia gas is usually pronounced incombustible and incapable of being exploded when mixed with atmospheric air, but research and experience have shown that this is not altogether true. A mixture of ammonia gas and air can be exploded if it contains from 16 to 27 per cent. of ammonia, and some of the explosions that have occurred in our big refrigerating plants subsequent to the liberation of considerable quantities of ammonia may possibly have been due to the ignition of mixtures of this kind by means of the arc lamps which have in most cases been in use in rooms where these accidents have occurred.

In compressing ammonia another source of danger must be carefully considered. If the ammonia gas that is undergoing compression is allowed to become unduly hot, the ammonia that comes away from the compressor will contain a notable quantity of combustible gas that is distinctly different from ammonia. This may come in some measure from the decomposition of the oil that is used in lubricating the compressor cylinder, but it also contains free hydrogen, which appears to be produced by the actual dissociation (or breaking up) of the ammonia into its component gases, nitrogen and hydrogen. We used to think of ammonia as being exceedingly stable and incapable of dissociating in this way to any sensible extent, but we now know that such is not the case. Dissociation occurs even at moderate temperatures, and it is likely to become quite significant when the temperature is high. To guard against the development of combustible decomposition products from the lubricating oil, it is important to use a special kind of oil which experience has proved to be well adapted to work of this kind; and to keep the dissociation of the ammonia itself within as low a limit as practicable, it is important to keep the gas as cool as possible by methods already outlined in connection with other gases. Finally, to guard against vapour explosions in case ammonia gas should escape in to the air in considerable quantity, it is important to take the same precautions against ignition sources that have been suggested in connection with hydrogen.

Chlorine

Liquid chlorine is now manufactured in large quantities for use in connection with bleaching, and for many other purposes. It has been greatly feared by the general public ever since it was used as a military gas in the war, but in time of peace this fear is hardly justifiable. Chlorine is exceedingly irritating, and it can produce unconsciousness and even death if inhaled in any considerable quantity. It has been well described as an "honest gas," however, the phrase meaning that it has no treacherous qualities. We always know exactly what it will do. In a manufacturing plant, or in a plant in which chlorine is compressed, immediate relief can be had, in case of leakage, by merely leaning out of an open window or going out of the room. It is not desired to underrate the dangers associated with handling liquid chlorine, yet it is only fair to say that they have been largely exaggerated. If a cylinder or a tank containing liquid chlorine bursts or springs a leak, for example, the evaporation that takes place rapidly chills the liquid still remaining in the tank, so that the evolution of gas is quickly and automatically checked, though

not wholly stopped. Abundant ventilation is important in a chlorine plant and special attention should be given to the exits, so that if the gas becomes accidentally liberated in considerable quantity the men can pass out into the open air as quickly and directly as possible.

Chlorine must be carefully dried before compression, because if it is moist it will corrode the pump, piping, and tanks. Perfectly dry chlorine, on the other hand, has practically no action upon iron. The drying is effected by passing the gas through towers filled with pumice wet with concentrated sulphuric acid. In liquefying the gas by means of a compression pump the main difficulty to be overcome is keeping the piston gas-tight in the compression cylinder. A special form of packing is required for this purpose, and it should be designed and installed by some person who understands the necessities thoroughly. In one compression plant visited by the author there are seven sealing rings on the piston—six soft and hard packings of special chlorine-resisting material being used, while the middle space is filled with strong sulphuric acid which not only completes the seal but also serves to lubricate the cylinder. The pressure required in chlorine tanks is not high, as the vapour pressure of liquid chlorine is only about 120 lb. per sq. in., at 70 deg. Fahr.; and even when a chlorine tank has been left standing in the sun for a considerable time, the pressure will hardly ever creep up as high as 160 lb. per sq. in. In liquefying this gas the compression is therefore performed in one operation. Tanks and other apparatus used in handling or storing chlorine must be clean and free from all other substances—solid, liquid, or gaseous—with which the chlorine might combine.

In conclusion, there is one general suggestion relating to safety-valves which applies to all gases. Some engineers discourage the use of safety valves on gas-compressing apparatus, partly because the escape of gas through them is a source of waste, and partly because it creates a special hazard, when the gases are toxic or inflammable. But it is not necessary to liberate the escaping gas at or near the work place, and it can often be discharged where it will not constitute a hazard to property. Hence this objection is not altogether well founded. In fact, relief valves should be provided in all cases, and the discharge problem should be considered on its own merits in each individual plant. It is often, and perhaps usually, practicable to have the discharge delivered back into the piping system on the low-pressure side of the compressor, so that there is no economic loss, and no hazard to the men nor to property.

Fan Standardisation

In common with other branches of engineering the necessity for standardising the terms used in stating the performance or capacity of fans, and also for a standard method of testing fans, has been apparent for some time—both to the users and to the makers. The Council of the Institution of Heating and Ventilating Engineers some time ago appointed a committee known as The Fan Standardisation Committee, having representatives of both fan manufacturers and users, together with representatives from the Admiralty and H.M. Office of Works. This Committee has been holding meetings at regular intervals since the Spring of last year. They find that there are many difficult problems to settle, and that very considerable differences of opinion exist, both amongst the fan makers and also amongst the users, as to the correct terms to use, and as to the best method of testing fans. They hope, however, eventually to clear up all misunderstandings and ambiguities, and to issue a standard list of terms, as well as to define a standard method of fan testing and a clear method of listing fan performances.

"Where to Buy"

THE July (1923) edition of "Where to Buy Everything Chemical," the technical editor of which is Captain C. J. Goodwin, shows an increase in size and in the number of the various headings under which the firms are grouped. The matter is divided into three sections—general chemicals, fine chemicals, and plant—and gives in a convenient form the information an inquirer looks for.

Synthetic Ammonia from Coke-Oven Gas

Success Claimed for Claude's Researches

THE efforts of M. Claude for applying his method of ammonia synthesis to the treatment of coke-oven gases have (according to the Paris correspondent of *Chemical and Metallurgical Engineering*) met with success. Claude, it is stated, has succeeded in obtaining hydrogen as a residuum from the dissolution, under pressure, of coke-oven gas in an appropriate solvent, which was actually ordinary ether. It was near the end of 1921, when Claude, at the Montereau Works, succeeded in making a very simple apparatus producing 230 cu. m. of hydrogen hourly from 500 cu. m. of water gas. He succeeded in using this hydrogen immediately in his production of ammonia. This first apparatus has now been replaced by one having twice that capacity, and the present apparatus is supplying a plant producing 5 metric tons of ammonia daily. The treatment of water gas was but an intermediate step toward the treatment of coke-oven gas.

Notwithstanding the small quantity of coke-oven gas heated (850 cu. m. per hour), the working pressure of the Béthune collieries apparatus is somewhat under 24 atmospheres. It is hoped that a pressure of below 15 atmospheres may be obtained with a new type of apparatus now being studied, which is designed to treat 5,000 cu. m. of gas per hour, equivalent to a daily production of 20 metric tons of ammonia.

Work at Béthune

At Béthune the gases treated are compressed on coming from the debenzolising appliances, to a pressure of approximately 25 atmospheres. The succeeding apparatus for treatment consists of a series of towers. In the first the gas comes in contact with a flow of heavy oil controlled by a small pump. Here any remnants of benzol still carried by the gas are scrubbed out. Thence the gases run into a second column, where they are decarbonated by means of a flow of lime water delivered by a centrifugal pump. The next stage in the process carries them to separators, where the water is taken out as well as any other condensable products. Ethylene, one of the most precious of these, can be recovered separately. The hydrogen taken out is then sent on to a gasometer, and the other gases carrying high methane contents are sent back to the works for utilisation. So low is the cost price of the hydrogen obtained as above described that it is possible to use the nitrogen produced in any one of the usual processes in common practice.

Some of the Results

Below are given certain of the results obtained at the Béthune collieries. When 850 cu. m. of gas were treated per hour, the amount of hydrogen obtained was approximately 425 cu. m. per hour, or 50 per cent. This analysed about 90 per cent. pure hydrogen, 1.6 per cent. carbon monoxide, and a remainder of approximately 9.4 per cent. of nitrogen. Ammonia was produced at the rate of 150 kg. per hour, of which 140 kg. was in the liquid state. The amount of power required for this operation, including the heating of the tubes, debenzolising and decarbonization, was approximately 460 kw. The physico-chemical method of decarbonization is to be replaced by a purely chemical method that will permit the reduction of power consumed in the apparatus as it is used at present.

Claude claims for his process great simplicity, as well as very low erection and labour costs. The fact that the gases are compressed for the purpose of recovering the hydrogen from them may be of advantage in carrying out the whole process of debenzolising under pressure. The yield in benzol would then be increased by 10 to 15 per cent., while the size of the absorption and distillation appliances would be reduced. Naturally, the amount of solvents or scrubbing oil and the unavoidable losses and the consumption of steam, etc., would also diminish.

As the various component parts of the gases are recovered and can be used separately, it is very likely that from 150 to 200 kg. of ethyl alcohol will be produced per metric ton of ammonia. The increase of the yield of benzol and the production of ethylene are alone sufficient to make up for the cost of compressing the gases in view of the hydrogen separation.

By-Product Recovery with Producer Gas

A New Low Temperature Process

THE by-product recovery gas producer process of the Power-Gas Corporation, Stockton-on-Tees, was introduced originally by the late Dr. Mond, and is well known, and many plants have been installed with mechanical or constructional developments under Mond, Lyman, and other patents, as time has elapsed.

In that process it was possible when using cheap slack to recover from 90 to 95 lb. of sulphate of ammonia per ton of fuel gasified, the gas yield at the same time amounting to about 135,000 c. ft. of 135 B.T.U. net calorific value per c. ft.

With cheap fuel of former times, these results, which were obtained by introducing into the producer 2½ lb. of steam per lb. of fuel gasified, represented a very economical source of heat, but with the advance in the cost of fuel and labour, etc., of late years the economic value of the process has been very materially affected.

As the result, however, of years of technical experiment, the Power-Gas Corporation has been able to improve the economy and efficiency of the system considerably, the lines adopted being the combination of the low temperature production of by-products (oils, pitch, and ammonia), with the gasification process in one operation.

The Nature of the Gas Produced

The results thus achieved may be immediately summarised as follows:—

Analysis of Fuel—		} on dry fuel.
Moisture	5.7 %	
Ash	8.0 %	
Volatile matter	31.2 %	
Total carbon	71.1 %	
Fixed carbon	56.6 %	
Hydrogen	5.0 %	
Nitrogen	1.47 %	
Nett calorific value B.T.U.'s per lb.	12,150	

Comparative Results (Old and New Process)—Long Period Averages.

Gas Analysis—	Old	New L.T.
	Process.	Process.
CO ₂	16.0 %	8.3 %
CO	11.0 %	21.0 %
H	25.0 %	20.5 %
CH ₄	2.5 %	4.9 %
N	45.5 %	45.3 %
B.T.U.'s nett per cub. ft.	134	178
Gas efficiency cal. value of gas cal. value of coal	68 %	80 %
Average gas yield per ton of dry fuel gasified	138,000	122,000
Average ammonium sulphate yield per ton of dry fuel gasified	95 lb.	90 lb.
Average yield of dry tar and oils per ton of dry fuel gasified	Low grade quality. Value negligible.	21 gals.
Steam per lb. of dry fuel gasified	2½ lb.	1 lb.

It will thus be seen that it is possible to make a producer gas much richer than that from hot gas producers, the said gas containing 21 to 22 per cent. carbonic oxide (CO) and only about 8 per cent. carbonic acid (CO₂). The hydrogen (H), although higher than in hot gas practice, does not replace CO as formerly, but is in addition thereto, resulting in a higher calorific value.

Valuable By-Products

The tar and oils produced can be readily dehydrated by mechanical treatment to within 2 per cent. moisture content, and have a high value, thus becoming important by-products. This is in contra-distinction to the old by-product producer tar, which was extremely difficult to handle and of low value.

The high yields of ammonium sulphate are all obtained as formerly.

One important characteristic which distinguishes the operation of the new process is that there is practically no dust or soot produced, whereas in the old process this was considerable, and required much labour for its removal from the plant, due to its frequent simultaneous deposition with the

thick tars in the mains. The fact of the much lower volume of steam entering the producer, and of the lower temperature and volume of the crude gas leaving the producer, accounts for this absence of dust and soot.

Principles of Operation

The production of the low temperature by-products is brought about by the transfer of heat to the fuel in the distillation zone in a gradual yet direct and efficient manner by the intimate contact of the hot producer gas evolved in the lower part of the producer, with each particle of the fuel in the upper zone. The fuel which is charged into the producer is maintained in the uppermost or primary zone at a temperature most suitable for the production of the largest quantity of tar oils and low temperature fractions, while the heat is evenly distributed throughout the whole mass. The tar oils and ammonia evolved in the secondary and tertiary (gasification) zones are always passed through zones that gradually become cooler and cooler, thus preventing cracking of the oils and destruction of the ammonia.

The distinctive feature of this new process is thus to be found in the combination of the ammonia recovery producer gas process, with a special type of low temperature distillation in one and the same generator and in one operation.

"Royal Welsh Perfume Water"

At Lambeth County Court, before Judge Parry, on Friday, July 27, Eck and James, of the Wellfield Chemical Works, Angell Road, Brixton, brought an action against Ernest Button, of Leather Lane, Holborn, claiming £10, balance of account.

Mr. Eck said that the defendant had two consignments of cheap perfume, the account coming to £15. He wanted it to sell at Mitcham Fair, the price being 7s. 6d. per gross of small bottles. He paid a traveller £5 on account, but the money was not received by the plaintiffs. They could not trace the traveller, who had since left their employment, but they were prepared to give the defendant credit for £5, although he had no receipt for it.

The defendant said he received a notice from the plaintiffs warning him not to pay the traveller any money. He paid the traveller £5, however, and he promised to send on a receipt, but did not do so.

Judge Parry: It was a very silly thing for you to do after you got the warning, but they are very kind to you, for they are not suing you for that. Why should you not pay the balance?

The defendant: The stuff is no good. I have over 200 dozen bottles left.

Judge Parry: I see it is called "Royal Welsh Perfume Water," but is made in Brixton.

Mr. James, giving evidence, was asked by Judge Parry if he was a Welshman. He replied that he was.

Judge Parry: And that is why it is called "Royal Welsh Perfume Water." I am a Welshman, but I did not think Welsh people went in for this kind of thing. His Honour had a sample box of the perfume handed to him, and after smelling it handed it back, remarking, "It has a horrid smell. Take it away."

Mr. James said it was sold as a water perfume.

The defendant: You cannot call it a perfume.

Judge Parry: I don't know what it is, but you will have to pay for it. There will be judgment for the plaintiffs for £10 claimed, and costs.

Recent Wills

Mr. Edward Ferguson Chance, of Sandford Park, Oxford, lately chairman and managing director of Chance Bros. and Co., Ltd., flint glass makers	£87,057
Mr. Ernest George Douglas, of Thornhill Gardens, Sunderland, managing director of the Avenue Paint Works, Sunderland	£8,282
Colonel John Goode Johnson, of Brinnington Hall, Stockport, Cheshire, bleacher	£28,619

The Institute of Chemistry

July Examination Results

THE following candidates have passed the examination, held this month, for the Associateship of the Institute of Chemistry of Great Britain and Ireland:—

IN GENERAL CHEMISTRY.—Anderson, Alex Carr, B.Sc. (Lond.) (University College, Nottingham); Barnett, John (East London College); Beard, Herbert Greensmith (Huddersfield Technical College); Bennett, William Frederick (Central Technical School, Liverpool); Booth, Walter (Central Technical School, Leeds); Bott, Thomas Harold, B.Sc. (Lond.) (College of Technology, Manchester); Bubb, Frederick James, B.Sc. (Lond.) (East London College); Child, Reginald (King's College, London); Crombie, William (Imperial College of Science and Technology); Crutchlow, Bernard William Alfred (King's College, London); Curtis, Ronald Hamilton (University College, London); Faichney, Peter (Heriot-Watt College, Edinburgh); Fairgrieve, Adam Wilson (Heriot-Watt College, Edinburgh); Groves, Adam Traill (Heriot-Watt College, Edinburgh); Harrow, Andrew Nicoll (Heriot-Watt College, Edinburgh); Hibbert, Sydney, A.M.C.T. (College of Technology, Manchester); Hill, Herbert Eric (University of Western Australia); Jones, Norman Ellathorne (King's College, London); Kimmins, Lionel George, B.Sc. (Lond.) (University College, London); Kirby, Christopher Stanhope (University College, London); Laing, William Mossman (Heriot-Watt College, Edinburgh); Leaper, Percy Joshua (University College, Southampton); Lindsay, Robert (University College, London); McGrath, James (Royal Technical College, Glasgow); Mieras, Adrian Pieter (Heriot-Watt College, Edinburgh); Mosley, Martin Aaron (University College, Nottingham); Moyes, Robert Baird (Heriot-Watt College, Edinburgh); Oliver, James Herbert, B.Sc. (Lond.); Paul, David (Heriot-Watt College, Edinburgh); Pound, Albert, B.Sc. (Lond.) (University College, Exeter); Rosewarne, Joel Alfred Henry Tetterdell (King's College, London); Russell, William Lyle (Heriot-Watt College, Edinburgh); Saunders, Harold Nicholas, B.Sc. (Lond.) (University College, Exeter); Scott, Robert (Heriot-Watt College, Edinburgh); Smith, Charles George (King's College, London); Snelus, Miss Suzanne Mabel Lavinia (College of Technology, Manchester, and Sir John Cass Technical Institute); Thacker, Gilbert Doe Dwyer Way (East London College); Thomas Brynmor, M.Sc. (Dun.) (Central Technical School, Liverpool); Threadgold, Herbert, B.Sc. (Lond.) (University College, London); Tully, James Duncan, B.Sc. (Lond.) (University College, Southampton); Walker, John (Technical College, Huddersfield); Wells, William Herbert (University College, London); Wilkie, Alexander Stewart (Heriot-Watt College, Edinburgh); Wilson, George Edward (Heriot-Watt College, Edinburgh); Wood, Thomas (Central Technical School, Liverpool); Wylie, Andrew Robertson (Heriot-Watt College, Edinburgh). Twenty-eight candidates failed to satisfy the examiners.

IN BRANCH (B): METALLURGICAL CHEMISTRY.—Howard, Thomas George (Sir John Cass Technical Institute).

IN BRANCH (E): CHEMISTRY, INCLUDING MICROSCOPY, OF FOOD AND DRUGS, AND WATER.—Woodhead, John Ezra, B.Sc. (Lond.) (Birkbeck College and Northern Polytechnic Institute, London).

IN BRANCH (G): CHEMICAL TECHNOLOGY.—Martin, George Frank (Royal College of Science, London).

The following Associates have passed the examination for the Fellowship:—

IN BRANCH (A): INORGANIC CHEMISTRY.—Hackney, Norman, B.Sc. (Lond.); Wynn, William Owen Roderick.

IN BRANCH (C): ORGANIC CHEMISTRY.—Cohen, Abraham, B.Sc. (Lond.).

IN BRANCH (D): AGRICULTURAL CHEMISTRY.—Ritchie, John Edwin, M.A., B.Sc. (Aberd.).

Kynoch, Ltd.

SIR HARRY MCGOWAN, presiding at the twenty-seventh ordinary general meeting of Kynoch, Ltd., called the attention of the shareholders to the values placed on the assets in the balance-sheet. The differences in the figures were mainly brought about by the adoption in 1922 of merger figures. The values of the assets had been adjusted in order to conform with the basis on which the shares of their company owned by Nobel Industries, Ltd., were acquired, after applying depreciation and giving effect to additions and sales since the date of acquisition. For some time past the board had felt that the valuation of shares more truly represented the real values than the amounts previously shown in the accounts, and he asked them to signify their acquiescence in the action taken by the board. The net profit for the year 1922 amounted to £98,291.

Sanitary Institute Congress

Professor Cohen on the Smoke Evil

At the Royal Sanitary Institute Congress at Hull on Tuesday, Professor Cohen, of Leeds University, read a paper on the smoke evil, in which he showed by a series of lantern slides the devastating effect of smoke and the consequent acidity of the atmosphere. The photographs included a number showing the effect of smoke on vegetation, ash trees stripped of their leaves, wheat and other cereals wilted and dwarfed by smoke, the colour bleached out of flowers by sulphuric acid in the air, and the surface of one of the Cumberland lakes covered by a film of soot blown across and deposited on the water from Barrow, or even more remote industrial centres. He urged the necessity for much more drastic legislation for the prevention of these horrors.

Mr. W. B. Smith, of Glasgow, insisted that the industrial smoke emitted into the air was unnecessary and wasteful. It could be consumed or condensed if manufacturers would take the matter seriously. We were in the same position with regard to air that our ancestors were in with regard to water. Enormous expense had been incurred to supply the people with pure water. Pure air was just as important, and should be insisted on even if some of the cost had to be borne by the local authorities.

Professor Cohen, in replying, said he thought health considerations ought to come even before industrial interests. This was one of the matters in which compulsion was desirable, and the Government should be able to act if necessary in advance of public opinion. We already had compulsory education, we ought to have compulsory vaccination, and smoke prevention was another matter in which compulsion was necessary.

The Problem of Milk

Dr. Stenhouse Williams described the methods by which grade A tuberculin-tested milk is produced in his establishment at Reading, and claimed that such milk could be delivered by rail at long distances in perfect condition. It could be produced at Reading at one penny per quart above market price, but he did not wish to guarantee that this could be done everywhere.

Dr. Moore, medical officer of health for Huddersfield, considered the price of grade A milk was prohibitive. He found it cost 7d. per pint in London. He hoped the Congress would abide by the resolution already adopted by the Royal Sanitary Institute in favour of pasteurised milk.

Dr. Howarth, medical officer of health for the City of London, deprecated the confusion introduced by so many grades of milk, which he said must include ordinary dirty milk, since its sale was not prohibited. He maintained that there should be only two grades—namely, that which was fit to drink and that which was unfit.

Dr. Wynne, medical officer of health, Sheffield, said he disapproved of the whole system of special designations of milk. Legislation on the subject was chaotic and its administration impossible. There were many practical objections to pasteurisation, and he believed that as far as northern industrial centres were concerned the problem had been solved by dried milk.

Eucalyptus Oil as Motor Fuel

THE Australian Commonwealth Government is interesting itself in the experiments of Captain C. M. Dyer with eucalyptus oil as a motor fuel. He claims to have established that eucalyptus oil can be used in petrol engines, with efficient means of vaporisation. The only difficulty is that it will not start an engine from cold without priming. On the other hand, the calorific value is high. Tests made with cheap cars are reported to have shown that a run on gasoline gave 24 miles to the gallon; on half-gasoline and half-eucalyptus oil, 28 miles; and on eucalyptus oil alone, 36 miles. He states that eucalyptus oil will mix with gasoline, benzol and alcohol, and that it acts as a decarbonizing agent, maintaining cylinders and pistons free from carbon. There are 170 varieties of eucalyptus in Australia. The oil yields range from 0.02 to 35 lb. per 1,000 lb. of leaf treated. Distillation is a simple process, requiring no skilled labour. The main difficulty of manufacture on a large scale would be labour for gathering the leaves.

Hydrogen Sulphide as an Industrial Poison

Bureau of Mines Research Work

HYDROGEN sulphide is an extremely toxic gas, sometimes present in mines, railroad tunnels, sewers, and marshes; and is found in various stages of the manufacture of sulphuric acid, and in the distillation of petroleum, particularly those oils known as high-sulphur crudes; also about some gas wells, gas plants, and smelters. In the chemical laboratory it is made for analytical purposes by the action of an acid on metallic sulphide. In mines it may exist as occluded gas in coal or rock strata, or may be formed by decomposition of sulphides in the presence of moisture.

Hydrogen sulphide is a colourless gas, which burns with a bluish flame, forming sulphur dioxide and water. In seven parts of air a mixture is formed which, when ignited, explodes with violence. Its molecular weight is 34, somewhat heavier than air. This gas can easily be dissolved in water, especially at low temperatures. The gas can be totally dispelled from the water by boiling. Aqueous solutions decompose slowly, especially when exposed to light, with deposition of sulphur.

Types of Poisoning

Wherever hydrogen sulphide exists, the possibility of poisoning is present. Its toxicity is comparable to that of hydrocyanic acid gas (prussic acid). A study of the accidents caused by hydrogen sulphide gas shows that the cases may be readily divided into two distinct types—namely, (1) acute, or asphyxiation; and (2) subacute, or irritation, resulting usually in conjunctivitis (inflammation of eyes), and signs of inflammation of the respiratory tract, such as pharyngitis (inflammation of the throat), bronchitis (inflammation of the lungs) and pneumonia.

A typical acute case of hydrogen-sulphide poisoning is as follows:—A student who had been generating hydrogen sulphide carelessly opened the hoods which contained the gas and breathed some of it for a period of possibly one minute. He fell unconscious to the floor, and his fellow-students carried him to fresh air. No treatment was given, and he was unconscious for only a few minutes. After regaining consciousness he went home, but returned to college the second day following. No after-effects were noted.

In subacute cases, symptoms of irritation of the eyes and respiratory tract are found. The degree of poisoning varies with the concentration of the gas present and the length of exposure. A typical subacute case of hydrogen-sulphide poisoning is as follows:—A labourer worked all night in an atmosphere containing a small amount of hydrogen sulphide. He complained that it pained his eyes, and the following day his cornea was lustreless and exceedingly painful. Marked lacrimation (tears in eyes) and photophobia (pain on exposure to light) existed. He was placed under the care of a specialist. The exposed portion of the cornea became cloudy, and later peeled. For several days the patient was unable to use his eyes, but at the end of a week the conjunctivitis cleared up, and his eyes were not permanently damaged. He was able to return to work after ten days' treatment.

Some Recent Experiments

An experimental study of the toxicity of hydrogen sulphide gas was made at the Pittsburgh Experiment Station of the Bureau of Mines, where equipment is available for the study of gas problems. A 1,000-cubic foot gas chamber was used for making all exposures of men and various animals. Hydrogen sulphide was made with a Kipp generator charged with iron sulphide and hydrochloric acid, washing the gas through water, and a measured quantity conducted into the chamber. Analyses were made of the atmosphere to determine the concentration of hydrogen sulphide by the cadmium chloride method.

Canaries, white rats, guinea pigs, dogs, and a goat were used as subjects. A few experiments were carried out on men, using low percentages of hydrogen sulphide. It was found that both types of action—that is, acute and subacute—could be produced in animals.

In acute cases of hydrogen-sulphide poisoning complete paralysis took place almost immediately—usually within a

few seconds to a minute. The animal sank to the ground unconscious. Hemorrhage from the nose and mouth occurred, but was not a constant finding. The pupils were dilated. The rate of respiration was sometimes at first slightly increased, followed by a decrease until there was a respiratory paralysis. There were spasms of the extensor muscles of the limbs, the abdomen became rigid, and a true opisthotonos (head and heels bent backward) was usually present. The heart was slowed during this respiratory depression, but the beat was full and of good tension. After about one minute the rate became rapid, and the pulse was of poorer quality, a flutter developed, and then the heart action stopped.

In the subacute cases the symptoms presented were quite different from those seen in the acute cases. Irritation of the eyes and respiratory tract was particularly noticeable, and the animals were first irritated and then depressed. This progressed into stupor, and finally unconsciousness. Considerable salivation was present, and hemorrhage from the nose often appeared. Respiration gradually increased in rate, and at times was laboured. Death intervened in about 10 to 18 hours in dogs subjected to 0.015 to 0.035 per cent. of hydrogen sulphide.

Death in acute cases is due to a respiratory failure followed by cardiac failure; and in subacute cases death is due to irritation of the respiratory tract followed by edema (fluid in tissue) of the lungs.

The after-effects observed resulted more often from the irritating effects of severe subacute poisoning than from the effects of severe acute poisoning. In acute cases, if there was recovery, it was rapid, but rarely were there any apparent effects after a few hours; but with the subacute cases death occurred 12 to 48 hours later, and autopsy showed edema and changes similar to the typical example previously described. In addition to these after-effects, diabetes, nephritis, pneumonia, and degeneration of the nervous system have occurred.

Prevention of poisoning, with a knowledge of the extreme toxicity of this gas, is most advisable. In various industries a number of mechanical devices have been designed for care of these fumes, the application of which will tend materially to decrease the number of accidents. The use of canister masks, hose masks, and oxygen breathing apparatus has proved of value—each having its peculiar application and limitation.

Summary

1. Hydrogen sulphide is an industrial poison, the toxicity of which has not been fully realised. Cases of poisoning have occurred in relatively large numbers. Constant vigilance is required in order to prevent accidents.

2. The poisoning by hydrogen sulphide is of two types—namely, acute and subacute—causing asphyxiation and irritation (conjunctivitis, bronchitis, pharyngitis and depression of the central nervous system), respectively. Death from asphyxia is caused by paralysis of the respiratory centre, while death from subacute poisoning is associated with edema of the lungs. The exact low limit of hydrogen-sulphide concentration at which it ceases to act as a poison has not as yet been determined, but is evidently below 0.005 per cent.

3. Hydrogen sulphide in low concentrations produces symptoms of headache, sleeplessness, dullness, dizziness and weariness. Pain in the eyes, followed by conjunctivitis, is fairly constant; while bronchitis and pains in the chest are frequent. Further poisoning produces depression, stupor, unconsciousness, and death. Spasms—clonic and tonic in character—are present, and death occurs following paralysis of the respiratory centre.

4. The pathology is typical of the two types of poisoning. In subacute cases there is destruction of the lining of the lungs, together with inflammation and edema. In the acute cases, where death is due to paralysis of respiration, the exact method of the poisonous action has not been determined.

5. Treatment of acute cases consists in immediate removal from the toxic atmosphere, and the immediate administration of artificial respiration. The breathing of oxygen is advisable when possible. The treatment of subacute cases should be symptomatic. All cases should be under the care of a physician. Where hydrogen sulphide gas may exist, good ventilation results in a decrease in the number of accidents. The canister type of mask, hose mask, and oxygen-breathing

apparatus are of value in protecting the men in case of emergency.

Conclusions

1. Hydrogen sulphide is an industrial poison.
2. Hydrogen sulphide is highly toxic.
3. Acute poisoning in men can be produced by concentration of 0.07 to 0.08 per cent. of hydrogen sulphide.
4. Acute poisoning by hydrogen sulphide acts on the central nervous system, resulting in a respiratory paralysis followed by cardiac failure and death.
5. At autopsy, cases of acute poisoning show cardiac dilation and congestion of the venous system. The lungs are collapsed.
6. Subacute poisoning by hydrogen sulphide is chiefly one of irritation of the respiratory tract and eyes, and depression of the central nervous system.
7. Subacute poisoning can be produced by long exposures to concentrations as low as 0.005 per cent.
8. At autopsy cases of subacute poisoning show signs of lung inflammation, edema, and dilation of the heart and venous congestion.
9. Microscopical examination indicates destruction of the cell lining of the lung alveoli in subacute cases.
10. All working places should be well ventilated.
11. Canister masks, similar to those used by the Army, hose masks, and self-contained oxygen-breathing apparatus are of value in protecting those who must enter atmosphere containing hydrogen sulphide. The canister mask will only protect against a moderate concentration of the gas.
12. Victims of acute hydrogen-sulphide poisoning may be saved by immediate removal from the poisonous atmosphere and applying artificial respiration.
13. Treatment of subacute poisoning should be given by a physician.

Deodorising Industrial Fumes

THE latest process for eliminating the unpleasant odours given off from various processes connected with getting by-products from the fertiliser, glue, soap, tanning, and varnish industries, perhaps the worst of all being the treatment of fats for the recovery of tallow, has been devised by two chemists of the Union Carbide and Carbon Research Laboratories. The fumes are passed straight from the processing apparatus to a vessel containing activated carbon, in which absorption is complete. The carbon, when saturated, may be revived without removal and thus renewed for a further period of activity.

The operation of the plant is as follows:—The kettle or other apparatus containing the vapours is closed, the vapours being drawn off through a pipe by a blower, which forces them through a chamber where cooling takes place by means of a water spray. The contaminated water is drawn off to a sewer from the bottom of this chamber. The cooled fumes then pass out of the chamber through a pipe into a tower containing activated carbon in a granular state. The purified gases are then discharged into the atmosphere. When re-vivifying of the carbon is necessary, steam is passed through it at 15 to 25 lb. pressure. This steam is forced through at the top of the tower and passes out at the bottom, carrying away the impurities held by the granular carbon.

The carbon tower is constructed of $\frac{1}{2}$ in. steel and is fitted with a grid horizontal partition in its lower part. This grid carries a galvanised-iron wire screen of 4 mesh and a brass wire screen of 20 mesh to carry the carbon. The carbon is prevented from being carried upward by the fumes by placing on top of it similar screens. These upper screens are movable, so that if the charge settles after impregnation they will follow it. The inlet and outlet of the gases is under control by valves, and the tower is heat-insulated to prevent radiation loss during re-vivifying. The carbon used is a highly activated coconut charcoal in granular form of from 8 to 14 mesh. This form of carbon was selected because it showed a high absorptive capacity for odours, has a selective absorption for organic and odorous substances instead of water vapours, resists abrasion and crushing, and is relatively dense.

Where continuous operation of such a plant is desired, a battery of two or more towers can be used, so arranged that they can be re-vivified in turn without interfering in any way with the continuity of the process of purification. The plant is simple, cheap, and effective, and should find a wide application in those industries where the gaseous by-products constitute a nuisance.

Chemical Matters in Parliament

White Lead

LORD H. CAVENDISH-BENTINCK (House of Commons, July 31) asked the Secretary of State for the Home Department whether legislation would be introduced to carry out the requirements of the Draft Convention on white lead adopted at the International Labour Conference in 1921 and whether the Government proposed to ratify this Convention.

The Under-Secretary of State for the Home Department (Mr. G. Locker-Lampson) said that the Home Secretary regretted he could add nothing at the moment to the replies given to previous questions on this subject. He hoped to be able to announce the decision of the Government when the House reassembled in the autumn.

Dyestuffs

MR. COLLISON (House of Commons, July 31) asked the President of the Board of Trade whether he was aware that users in Japan of 99-100 per cent. synthetic indigo could buy from British dye makers at 5s. per lb. whilst the sum of 8s. 6d. per lb. was charged to the British user; that this difference in price was due to the fact that British dye makers had a monopoly in this country both in manufacturing and in the distribution of imported German dyes; and whether he would inquire into this matter with a view to removing this grievance. Sir P. Lloyd-Greame said that he had been informed by the only British makers of synthetic indigo that none of that product was being sold by them in Japan.

Mr. Spencer asked the President of the Board of Trade (1) whether his attention had been called to the statement of the president of the Colour Users' Association to the Manchester Chamber of Commerce of February 23, 1923, in which he asked the Government to redeem its pledge that the Act should not jeopardise the using industries, and whether the Government does propose to do so; also (2) whether his attention had been called to the statement of the president of the Colour Users' Association that prices both of home-produced and reparation dyestuffs were at an artificially high level, 300 to 400 per cent. above pre-war, and what steps he proposed to take to remedy this.

Sir P. Lloyd-Greame replied that effort was being made to secure that the Dyestuffs (Import Regulation) Act was administered in such a manner as to promote the best interests of both parties.

Titanium Dioxide

MR. G. STREATFEILD MORLEY, M.I.C.E., in a note to the *Times*, states: "About three years ago it was discovered that what had hitherto been considered a useless by-product in the process of extracting aluminium from the Bauxite mineral obtained from the extensive beds of Bauxite at Katni, in India, was in fact far more valuable than the aluminium itself with which it was associated. This substance was no other than Titanium Dioxide, constituting a most perfect substitute for white lead, the basis of what has ever been considered the most durable of white paints. It has the further advantage of possessing five times the covering power of white lead, and will not tend to turn black as does white lead in the impure atmosphere of our cities. Since then I have heard that an extensive deposit has been discovered in France. Being a by-product of the aluminium process it should shortly be on the market at a comparatively low price."

Miscellaneous Uses for Waste Slate

WASTE slate fragments maybe utilised to some extent for sidewalk stone, building stone, and fence posts, states Dr. Oliver Bowles, mineral technologist of the Department of the Interior, in Bulletin 218 of the U.S.A. Bureau of Mines. As slate presents an exceptionally satisfactory surface for painting, the use of waste slabs for sign boards merits consideration. Slate waste has been tried as railroad ballast, but the tendency for the flat fragments to slide on each other results in instability and gradual flattening of the grade. Consequently there is no prospect of finding any extended field of utilisation in railroad work, except possibly in the use of the larger massive fragments. Slate pulverises to dust too readily for a road surface, but it may have some value in road construction when applied to the lower courses.

From Week to Week

MR. ERNEST CHAPMAN, M.Sc., has been awarded the Sir Clement Royds Memorial Scholarship in Chemistry in the University of Manchester.

ROBINSON BROTHERS, LTD., chemical manufacturers and engineers, of West Bromwich, secured two first prizes at Tunbridge Wells Agricultural Show for their horse-drawn powdering machine.

THE MANAGING DIRECTOR of Courtaulds, Ltd., has left for Canada to select a site and arrange for the erection of plant for a factory intended to meet the entire needs of the Canadian artificial silk market.

SIR WILLIAM POPE and a delegation from the British Association, are attending the forty-seventh Congress of the Association for the Advancement of Science, which opened at Bordeaux on Monday.

PROFESSOR J. B. COHEN and MR. W. S. CURPHEY (late Chief Inspector under the Alkali Acts) have been appointed on a Government Committee to consider the problem of smoke abatement and the emission of dust and grit from industrial works, etc.

SIR FREDERICK BECKER, a paper pulp manufacturer, left Southampton last week for Canada, where he will remain for three months investigating large scale experiments with a process shortly to be installed at Northfleet, Kent, for chemically treating straw fibre for conversion into paper pulp.

THE CLOTHWORKERS' COMPANY of the City of London have offered an annual contribution of £3,000 for the period of five years 1923-1927 to the governing body of the Imperial College of Science and Technology, South Kensington, to be applied towards the maintenance and development of the City and Guilds (Engineering College) one of the three constituents of the Imperial College of Science.

THE INTELLECTUAL CO-OPERATION COMMISSION of the League of Nations decided on Saturday, July 28, to submit to the Council and to the Assembly of the League a draft Convention for the Protection of Scientific Discoveries, drafted by Professor Ruffini. The Commission is asking the various Governments to establish for scientific discoveries a copyright similar to that granted for literary and artistic work.

IN THE ANNOUNCEMENT made by G. H. B. Brotchie and Co., Ltd., 32, Fenchurch Street, London, of the "Tixit" smoke-black carbon, recently put on the British market, the percentage of carbon has been inadvertently given as 95.75 per cent. instead of the appreciably higher figure of 99.75 per cent. It is suitable for use in the rubber, paint, and several other industries, and only chemical merchants are supplied.

THE BIRMINGHAM FIRE BRIGADE was on Tuesday evening called to a fire at the premises of the Birmingham Oil and Colour Company, in Montgomery Street, Sparkbrook. The outbreak was discovered in one of the four small shops at the rear of the premises used for the storing of oils, paints, and other highly inflammable material. The explosion of several of the vats added to the firemen's difficulties, but after an hour's work the flames were overcome.

APPLICATIONS for Yarrow Research Professorships will be received by the secretaries of the Royal Society until October 1 next, as the president and council of the Society will in the autumn consider the appointment of one, or possibly more, professors who will be expected to devote their whole time to research in the mathematical, physical, chemical, or engineering sciences. Further particulars are obtainable from the Assistant Secretary of the Royal Society, Burlington House, Piccadilly, London.

THE APPOINTMENT of MR. J. E. ZANETTI, assistant professor of chemistry in Columbia University, to serve on a committee of the League of Nations for the investigation of the whole problem of chemical warfare, is described by the American Chemical Society as the first intimation in the United States that the League had entered upon an exhaustive study of the subject. Professor Zanetti, who is now in England, will be associated in this work with Sir William Pope (Cambridge), Professor Moureu (Paris) and other well-known chemists representing different nations.

THE FUNERAL took place on July 25 of Mr. Edgar Vincent Chambers, of Chambers and Hammond, chemical engineers, Lightcliffe, Yorkshire. During the war Mr. Chambers went

to Lightcliffe, became general manager at Brookes' Chemical Works, Ltd., and was responsible for the foundation of the picric acid works there. After the war he started business on his own account together with Mr. Hammond. Mr. Chambers did not take much active interest in local affairs beyond giving lectures to various organisations. He was 44 years of age, and leaves a widow and two daughters.

THE DISCOVERY of an animal starch called "Glucokinine," which is said to have a similar value to insulin in the treatment of diabetes but is much cheaper, is announced by Professor J. J. Wiltman, of the University of Minnesota, through the American Chemical Society. The credit of the discovery is given to Dr. J. B. Collip, of the University of Alberta. Glucokinine, it is stated, has been successfully tried on diabetic rabbits and dogs, but no experiment has yet been made on human beings. It is extracted from lettuce and bean leaves, wheat, onions, clams, oysters, yeast or mushrooms. Its effect develops slowly and is long maintained.

PRESENTATIONS were made in Liverpool on Tuesday by the Lord Mayor to four men whose prompt action averted an explosion of a load of picric acid. During loading operations an accident to a crane threw the boiler fire beneath some railway wagons containing picric acid, and the men at great risk extinguished the fire, and prevented what must have been a disastrous explosion. To each of the men was handed a cheque for £10, with an assurance that cheques for the same amount would be paid over to them or their widows and children every July for the next ten years. Gold medals are to be presented to the men later.

THE DEPARTMENT of Overseas Trade and the Birmingham Committee, the respective organising authorities for the London and Birmingham sections of the British Industries Fair, have decided that next year's Fair, instead of taking place at the end of February, as would normally be the case, shall be postponed for two months. This means that the British Industries Fair will open in London on April 28, continuing until May 9, while the Birmingham section will open on the Monday following the close of the Fair in London. There will be no chemical section next year, in consequence of the decision of the organisers to concentrate on the chemical section at the British Empire Exhibition.

THE HULL CHEMICAL AND ENGINEERING SOCIETY has arranged an interesting programme of papers and works visits for the session 1923-24, which opens on October 2. The works to be visited include those of Major and Co., distillers, Sulcoates, and the Hull Ice Co.'s factory. Among the readers of papers are Mr. G. B. Shaw ("British-made Dyes for Paints and Distempers"), Mr. A. V. Slater ("Recent Advances in Colloid Chemistry"), Dr. J. Newton Friend ("Recent Advances in the Study of Corrosion"), Mr. A. R. Tankard ("Living Micro-organisms"), Dr. W. Thevenaz ("Anthracene and its Derivatives"), and Mr. A. R. Warnes (whose presidential address will deal with "The Constitution of Coal"). During the session a joint meeting with the Chemical Engineering Group is to be held.

DR. A. E. H. TUTTON, whose presidential address to the Devonshire Association, at Salcombe, was recently noticed, is congratulated by *Nature* on the completion of a laborious piece of work which he set himself in 1890. This was the investigation of the isomorphous relations existing between the sulphates and selenates of the alkali metals and ammonium and the double salts of these with certain divalent metals. This work has been performed in his spare time, and for the last twelve years in Devonshire. In his presidential address he gave a general review of the results attained and of their bearing on the structure of crystals and of atoms. In all, 75 salts have been worked out in the greatest possible detail and their crystallographic and other constants determined with the highest degree of accuracy, for which purpose several elaborate instruments were specially designed. In 18 groups, in which potassium, rubidium, and caesium are the replacing elements, it is repeatedly and conclusively proved that the constants vary with the atomic weights of these elements, and consequently also with their atomic number and atomic diameters. The dimensions deduced for the structural units of these crystals have since been amply confirmed by the X-ray analysis of crystal-structure. But the more direct and very carefully made observations will be of permanent value for testing theories of the future.

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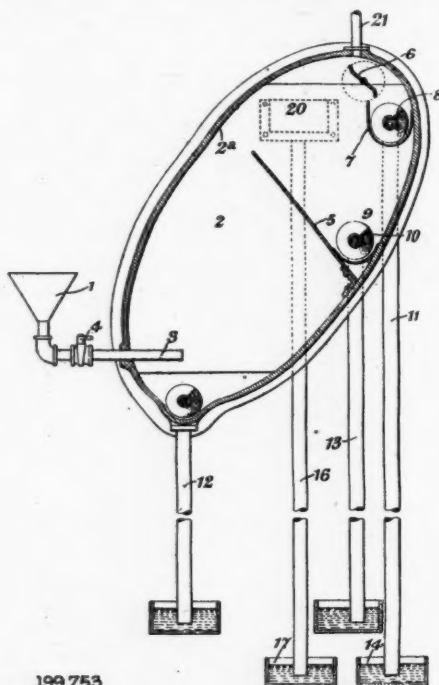
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Patent Literature

Abstracts of Complete Specifications

199,753. FLOTATION OF PARTICLES OF SOLID MATTER, PROCESS AND APPARATUS FOR. B. E. Eldred, 66, Myrtle Avenue, Flushing, Long Island, New York. Application date, January 5, 1922.

In this process, mineral particles are separated from gangue or waste material by increasing the difference of density between the two, and then separating them by gravity. The difference in density is produced by making use of the absorptive power for gases. The material to be separated is supplied from a hopper 1 to a chamber 2, together with water which is preferably freed from dissolved gas. The chamber 2 is connected by a pipe 21 to a vacuum pump, and when the pressure is reduced, the occluded gas develops on the surface of the



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particles in the form of bubbles. This formation of bubbles takes place under different conditions for the minerals and for the gangue, so that the two may be separated. The minerals float to the surface, forming a quiescent layer which may be transferred by means of a paddle 6 into a launder 7, from which it is removed by a conveyor 8. Some of the mineral particles may not float to the surface at first, but will develop a fresh layer of gas later, which will cause them to float. Alternatively these particles may be caught as they sink by means of a baffle 5, and finally removed by a conveyor 10. The material may be discharged by the conveyor 8 into a barometric leg 11, which is of such a length as to ensure sealing against the inflow of air. Similar discharge pipes 12, 13 may be provided for the gangue and for the material discharged by the conveyor 10, and an overflow vessel 20 with discharge pipe 16 is provided to maintain the liquid level at the desired point in the vessel 2. This process differs from the froth flotation process in that agitation and aeration of the liquid are unnecessary, the separation of the mineral and gangue being effected solely by the difference in density due to the extraction of the occluded gas.

199,759. FORMALDEHYDE, MANUFACTURE OF AQUEOUS SOLUTIONS OF. L. M. Hirschberg, Audrey House, Ely Place, London, E.C.2. Application date, February 22, 1922.

Commercial formaldehyde is usually in the form of a solution in water containing methyl alcohol, the alcohol being present

to hinder polymerisation. The 40 per cent. solution of formaldehyde usually contains 12—15 per cent of methyl alcohol. It is now found that polymerisation is due to the presence of acetals, *e.g.*, methylal, which is produced from the methyl alcohol in the solution. In this invention, the mixture of formaldehyde, methyl alcohol and water in the form of vapour is fractionally condensed to obtain an aqueous solution of formaldehyde containing the minimum proportion of alcohol. For this purpose, the temperature is maintained at 90°—95° C., when the condensate contains only 0.1 to 0.2 per cent. of methyl alcohol. The mixture is treated in a rectifying column, and the aqueous condensate removed from the lower plates as soon as it is formed. The vapour is obtained from a commercial solution of formaldehyde by passing a current of hot gas through, which dissociates any acetals in the solution. Alternatively the gas may be obtained from apparatus in which formaldehyde is produced from methyl alcohol. The presence of methyl alcohol in the formaldehyde is not necessary to prevent polymerisation.

199,760. FORMALDEHYDE, PRODUCTION OF, BY CATALYSIS. L. M. Hirschberg, Audrey House, Ely Place, London, E.C.2. Application date, February 22, 1922.

Methyl alcohol is mixed with a gas containing free oxygen such as air, and a quantity of water vapour in excess of that which would be taken up by the gas from methyl alcohol of 96 per cent. strength. The proportion of oxygen containing gas relatively to the methyl alcohol is not substantially more than one molecule of oxygen to two molecules of methyl alcohol. The proportions of water to methyl alcohol may vary from 1 : 24 to 1 : 9. The proportion of each material supplied to the catalyser can be varied independently of the other materials. Water vapour is preferably used in the form of superheated steam.

199,766. LOW BOILING POINT HYDROCARBONS FROM PETROLEUM OILS, PROCESS FOR THE CONTINUOUS PRODUCTION OF. R. W. Hanna, 474, Carlson Avenue, Richmond, Contra Costa, Cal., U.S.A. Application date, February 27, 1922.

The object is to obtain from high boiling oils a distillate which contains the maximum hydrogen content, for subsequent cracking to produce low boiling point hydrocarbons. The heavy oil is distilled under a reduced pressure so as to lower the vaporising temperature below the decomposition temperature of the oil undergoing distillation. The oil is passed through heat exchangers into a still which is maintained at a temperature to vaporise the desired fractions. The temperature depends upon the rate of distillation and the reduction of pressure in the system. The distillation products are passed through the heat exchangers and condensers. The high boiling distillate is then mixed with a solvent oil which is not cracked at the temperature employed for the cracking of the distillate. The solvent oil may be a distillate from refractory California crude oil, which contains a high percentage of naphthene and aromatic hydrocarbons. The heavy residues resulting from the cracking are thus kept in solution and the deposition of carbon is prevented. As an example, the solvent oil may be added in the proportion of 3 to 5 times that of the oil to be cracked, and the cracking may be effected at a pressure of 105 lb. to 120 lb. per square inch absolute, and a temperature of 745°—800° F. The process is continuous, and the volume of oil, temperature, and pressure in the closed system are maintained substantially constant.

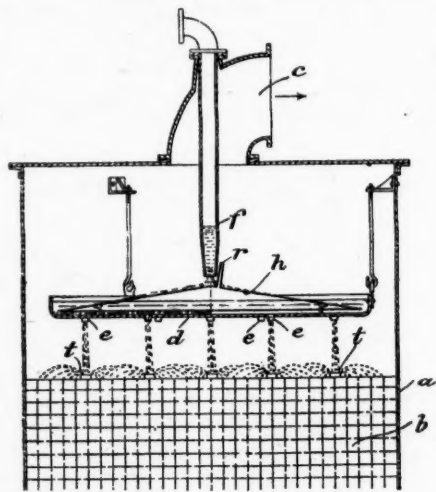
199,771. AZO-DYESTUFFS, MANUFACTURE OF. A. G. Bloxam, London. From Chemische Fabrik Griesheim Elektron, Frankfurt-on-Main, Germany. Application date, March 2, 1922.

Monoazo dyestuffs are obtained by combining any diazo compound with an ortho-toluidide of 2 : 3-oxynaphthoic acid (except the nitro substituted one). The halogen compounds, particularly those containing halogen in both components, are particularly fast to light. The process permits the utilisation of ortho-toluidine and ortho-nitrotoluidine, the latter of which is the chief product of the nitration of toluene. The dyestuff can be prepared in substance or on a substratum

or on the fibre. Reference is directed, in pursuance of Section 7, sub-section 4 of the Patents and Designs Acts 1907 and 1919, to Specifications Nos. 6379/1912, 23,732/1913, and 10,085/1914.

199,847. * SPRINKLERS FOR COOLING TOWERS, GAS SCRUBBERS, AND THE LIKE. Firm of C. Still, and A. Kuhn, Recklinghausen, Westphalia, Germany. Application date, April 6, 1922.

The gas is passed upwards over wooden slats *b* arranged within a casing *a*, which are sprayed with water from a tray *d*. The horizontal base of the tray is provided with short nozzles *e* of such dimensions as to maintain an equilibrium between the supply to and discharge from the tray. A small impact

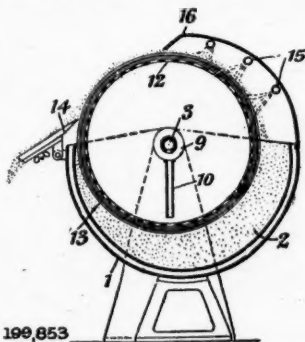


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plate *t* is arranged immediately below each nozzle. A flat tapered hood *h* is arranged within the tray so as to cover all the nozzles, and so that the lower edge is immersed in the liquid in the tray. The liquid is supplied by pipe *f* to the centre of the hood. The supply of the liquid to the tray around its periphery ensures a uniform depth over all the nozzles, since the rate of flow over the surface of the tray is slow. Any excess of liquid is distributed over the edge of the tray. The nozzles *e* may be interchangeable to vary the amount of liquid discharged.

199,853. ROTARY FILTERS. Plauson's (Parent Co.), Ltd.; 17, Waterloo Place, London, S.W.1. From H. Plauson, 26, Jarresstrasse, Hamburg, Germany. Application date, April 10, 1922.

The material to be filtered is contained within a casing *1*, and a filter drum *4* supported within it on a horizontal shaft *3*. The drum is made up of wire wound circumferentially round a



199,853

perforated member *12*. The solid material deposited on the drum is removed by a knife *14*, and the wire is protected from injury by circumferential metal ribs *13*. The deposit may be washed by spraying jets *15*, and the filtered liquid is drawn through depending pipes *10* into the hollow shaft. The filter may be constricted by the precipitate, or by cementitious

material such as gypsum, or by means of an aqueous suspension of asbestos meal or other fibrous material. A further constriction may be obtained by impregnating the set material with a colloid such as rubber solution, in which case a high vacuum is necessary for filtration.

199,886. OXIDATION PROCESSES. J. Y. Johnson, London. From Badische Anilin and Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Application date, May 2, 1922.

The process is for the catalytic oxidation of organic compounds, *e.g.*, hydrocarbons, in gaseous form. It is found that contact material, containing oxides of boron or phosphorus are capable of transforming hydrocarbons which are not readily attacked by oxygen, into products of an intermediate stage of oxidation such as aldehydes or ketones. The oxides of boron or phosphorus may be distributed on carriers with or without other additions. The boron oxide may be fused with silicon, kieselguhr, metallic oxides, carbonates or nitrates, or carriers such as firebrick or magnesite may be soaked with boric or phosphoric acid. The gaseous compound is passed together with oxygen over the catalyst. In an example, a mixture of ethylene 85 parts and oxygen 15 parts is passed over the catalyst at about 375° C. The catalyst may be produced by impregnating burnt clay with aqueous boric or phosphoric acid, and heating to about 500° C., or a mixture of boric or phosphoric acid and diatomaceous earth, and heated to red heat. Formaldehyde is obtained and absorbed in water, and the gas then treated with fresh oxygen. If methane is used the oxidation temperature is about 575° C. Acetone or ethyl alcohol may also be oxidised to formaldehyde at 520°—560° C., and formaldehyde is also obtained by passing air containing 1.7 per cent. of cyclohexanone over a catalyst at 320°—330° C. Air containing 2 per cent. of anthracene may be oxidised at 400°—430° C., yielding anthraquinone. A mixture of air with 1/7 of its volume of benzyl alcohol yields benzaldehyde at 250°—300° C. Air containing 5 per cent. of ethyl alcohol is oxidised to acetaldehyde at 250°—300° C., or formaldehyde 380°—400° C.

NOTE.—Abstracts of the following specifications, which are now accepted, appeared in THE CHEMICAL AGE when they became open to inspection under the International Convention: 186,606 (H. Howard), relating to purification of hydrofluoric acid, see Vol. VII., p. 798; 192,041 (C. Bianco), relating to zinc electrolytes, see Vol. VIII., p. 317.

International Specifications not yet Accepted

197,966. COLLOIDAL SOLUTIONS. Oderberger Chemische Werke Akt.-Ges., Oderberg, Czecho-Slovakia. International Convention date, May 19, 1922.

A substance is mechanically dispersed in a medium in the presence of the usual protective colloid and also a sufficient quantity of an electrolyte to precipitate the sol if it were at rest. The process yields sols of any desired concentration, which are only coagulated by very strong alkalis or acids. Further concentration is effected in a centrifugal apparatus, and the sols may be dried to produce reversible gels. Examples are given of the colloidalisation of crude sulphur and lamp-black in the presence of glue and common salt.

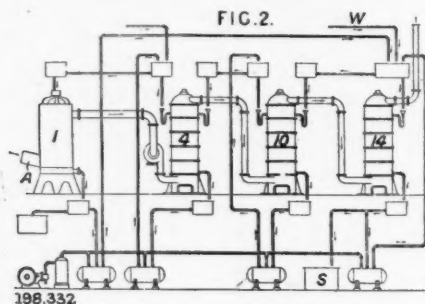
198,328. ACTIVE CHARCOAL. Allgemeine Norit Maatschappij (General Norit Co., Ltd.), 2, Den Texstraat, Amsterdam. Assignees of J. N. A. Sauer, 2, Den Texstraat, Amsterdam. International Convention date, May 26, 1922.

The process is for producing active charcoal, or regenerating spent charcoal. The raw material, which may be the less porous kinds of coal, brown coal or anthracite, is pulverised and then heated and agitated in the presence of steam, carbon dioxide, carbon monoxide, air, oxygen, chlorine, hydrogen, flue gases, generator gases, etc. The material may be passed through a number of horizontal retorts in series, into some of which air diluted with nitrogen, flue or generator gas, and steam are admitted. The raw material may be subjected to preliminary distillation.

198,332. SULPHURIC ACID. W. F. Lamoreaux, Isabella, Tenn., U.S.A. International Convention date, May 29, 1922.

Gases containing sulphur dioxide and oxides of nitrogen pass into a Glover tower *1* by a pipe *A*, and then to a washer *4*, into which nitrous vitriol is sprayed. Sulphur trioxide is pro-

duced, and passes into a washer 10 in which the liberated nitrous compounds are absorbed in acid of 59–61° Bé. The sulphur trioxide is condensed in another washer 14, which is supplied with acid of 97–99 per cent. strength, and this strength is maintained by the addition of water or steam through a pipe W, or weak acid from the Glover tower. Some of the acid is used in the washer 10, and the remainder is drawn off to the



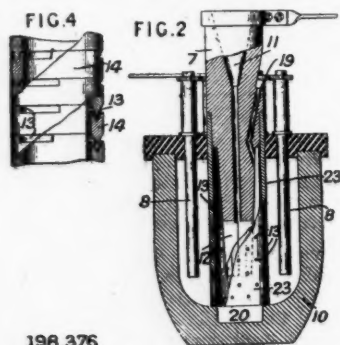
tank S. Nitrous vitriol is withdrawn from the absorber 10 and supplied to the washer 4 in such quantity that the acid drawn from the washer is practically denitrated, and the denitration is completed in the tower 1, yielding an acid of 60° Bé. The gas washers may be of the Feld type.

198,374. PURIFYING LIQUIDS. J. N. A. Sauer, 43, Johanna-Verhulststraat, Amsterdam. International Convention date, May 26, 1922.

The process is for treating sugar solutions, glucose, invert sugar, vegetable and fruit juices, glycerine, water, oils, fats, benzine and petroleum. The liquid is treated simultaneously or successively with externally precipitated lime salts and with decolorising carbon, bone or blood charcoal, kieselguhr, fuller's earth, kaolin, or silicic acid, and this may be followed by a chemical treatment.

198,376. ELECTROLYTIC FURNACES. B. E. F. Rhodin, 11, Hamford Place, Caldwell, N.J., U.S.A. International Convention date, May 26, 1922.

In a furnace for the production of magnesium, sodium or potassium, the chlorides are fed through a central passage 11 in the anode 7, and then through slots 12 into the vessel 10. To



prevent recombination of the liberated elements, a perforated partition 23 of aluminium is provided, having a gas outlet 19 through the anode. The partition may be built up of sections 14. The vessel may form the cathode, or separate cathodes 8 may be used.

198,379. SYNTHETIC DRUGS. Chemische Fabrik auf Actien (vorm. E. Schering), 170, Mullerstrasse, Berlin. International Convention date, May 29, 1922. Addition to 158,558.

In specification 158,558 C.C. diethylbarbituric acid is melted with 4-dimethylamino-2-3-dimethyl-1-phenyl-5-pyrazolone to form a new compound, and in the present invention any C.C. derivative is substituted for the diethyl compound. Examples are given.

LATEST NOTIFICATIONS.

- 201,131. Recovery of calcium oxalate and other materials from trees. Bhopal Produce Trust, Ltd. July 24, 1922.
201,150. Manufacture of new azo-dyes. Farbenfabriken vorm. F. Bayer and Co. July 18, 1922.

Specifications Accepted, with Date of Application

- 175,285. Phenol and its homologues, Removal of—from waste waters. E. Possever, Abwasser und Wasserreinigungs Ges. February 10, 1921.
178,824. Complex arseno-stibino compounds and process of making the same. H. A. Metz. April 21, 1921.
181,722. Tin, Process for extracting. C. Clerc and A. Nihoul. June 15, 1921.
182,487. Aromatic compounds, Process of oxidising. A. Eckert. July 2, 1922.
186,316. Sulphuretted hydrogen from gases, Process of removing. Ges. für Kohlentechnik. September 20, 1921.
187,605. Urea and formaldehyde, Process for the manufacture of condensation products from. H. Goldschmidt and O. Neuss. October 17, 1921.
187,964. Cellulose acetates, Dyeing of. R. Clavel. October 27, 1921.
196,560. Separating gases from a mixture, Method of and apparatus for. Naamlooze Vennootschap Philips' Gloeilampenfabrieken. April 19, 1922.
200,533. Colloidal-chemical processes for purifying substances. A. G. Bloxam. (Elektro-Osmose Akt.-Ges. [Graf Schwerin Ges.]) December 30, 1921.
200,534. Light oils such as gasoline, Method and apparatus for making. A. E. White. (Texas Co.) January 12, 1922.
200,574. Pigments and methods for producing same. H. H. Buckman. April 11, 1922.
200,584. Electrolysis of water. R. Pechkranz. April 13, 1922.
200,604. Gas, Manufacture of. Humphreys and Glasgow, Ltd. (O. B. Evans and H. G. Terzian.) April 21, 1922.
200,642. Filtering apparatus. E. L. Oliver. May 16, 1922.
200,651. Dehydrating tar, Apparatus for. Coke and Gas Ovens, Ltd. (C. Still.) May 22, 1922.
200,693. Lead compounds, Production of—and the manufacture of paints and anti-corrosive compounds therefrom. A. W. Topp. July 7, 1922.
200,701. Sulphide ores and equivalent metal-bearing materials, Treatment of—for the recovery of useful products. E. A. Ashcroft. July 14, 1922.
200,714. Intermediate compounds for the production of colouring matters, Manufacture of. British Dyestuffs Corporation, Ltd., and H. H. Hodgson. July 29, 1922.
200,732. Mineral-washing processes and plant. A. France. September 1, 1922.
200,739. Mono-azo dyestuffs, Manufacture of. O. Y. Imray. (Chemische Fabrik Griesheim Elektron.) September 18, 1922.
200,760. Alkali thiosulphates from solutions, Recovery of. W. J. Meilersh-Jackson. (Koppers Co.) November 21, 1922.

Applications for Patents

- British Dyestuffs Corporation, Ltd., Hailwood, A. J. and Lefebure, V. Vulcanisation of caoutchouc. 19,197. July 26.
Chance and Hunt, Ltd., Gidden, W. T., and Maudsley, R. T. Acid-resisting cements. 19,223. July 26.
Chatelan, J. Vulcanisation of caoutchouc, etc. 19,311. July 27. (Germany, July 28, 1922.)
De Laval Chadburn Co., Ltd. Centrifugal separators for dehydrating, etc., oil. 19,091. July 25.
Henkel et Cie and Weber, W. Treatment of ammonium chloride lyes in iron vessels. 19,218. July 26. (Germany, May 25.)
Hocking, C. M. Desulphurising shale distillates. 18,988. July 24.
Johnstone, H. Centrifugal separators for dehydrating, etc., oil. 19,091. July 25.
Kilby, W. and Morton Sundour Fabrics, Ltd. Dyeing cellulose acetate fibres. 19,261. July 27.
Michael and Co., J. Manufacture of nitrate of potassium. 19,229. July 27. (Germany, December 7, 1922.)
Moeller, W. Manufacture of tanning extract. 19,294. July 27. (Germany, May 1.)
Naamlooze Vennootschap Nederlandsche Gisten Spiritus Fabriek. Process for producing a non-peroxidising ether. 19,012. July 24. (Holland, July 21.)
— Production of chemically-pure, toxic free, narcotising ether. 19,026. July 24. (Holland, July 21.)
Plauson's (Parent Co.), Ltd. and Plauson, H. Dyeing. 19,067. July 25.
Sutcliffe, E. R. Distillation of carbonaceous substances. 19,121. July 25.
United Alkali Co., Ltd. Polishes for furniture, etc. 19,081. July 25.

Market Report and Current Prices

Our Market Report and Current Prices are exclusive to THE CHEMICAL AGE, and, being independently prepared with absolute impartiality by Messrs. R. W. Greeff & Co., Ltd., and Messrs. Chas. Page & Co., Ltd., may be accepted as authoritative. The prices given apply to fair quantities delivered ex wharf or works, except where otherwise stated. The current prices are given mainly as a guide to works managers, chemists, and chemical engineers; those interested in close variations in prices should study the market report.

London, August 2, 1923.

BUSINESS still continues on the quiet side and the effect of the holiday season is also very apparent. Export demand is slightly better, without any very special feature to report.

General Chemicals

ACETONE continues practically unobtainable, and a premium is paid for near delivery.

ACID ACETIC continues firm and scarce, and the price has a rising tendency.

ACID CITRIC has been a better market.

ACID FORMIC is quietly steady.

ACID OXALIC.—The demand leaves much to be desired, but the price seems to have steadied somewhat.

BARIUM CHLORIDE.—The demand is small and price easy.

BLEACHING POWDER.—Unchanged.

CREAM OF TARTAR continues extremely firm, and somewhat fair business has been booked.

FORMALDEHYDE is again higher, with practically nothing offering on the spot.

LEAD ACETATE is in good demand, and the price very firm.

LITHOPONE is moderately active at last quoted figures.

MAGNESIUM CHLORIDE.—Business has been done at the advanced figure, with supplies on the short side.

CAUSTIC POTASH is inclined to be higher, with a little better demand.

POTASSIUM CARBONATE is unchanged.

POTASSIUM PRUSSATE has been much more active, and the recent reduction in price has stimulated business.

SODIUM ACETATE is firm, and in light supply.

SODIUM BICHROMATE.—Business has been slightly better at English makers' figures.

SODIUM NITRITE has been in much better demand, but the price is unchanged.

SODIUM PHOSPHATE.—Unchanged.

SODIUM PRUSSATE is extremely weak, and business reported is only of the hand-to-mouth variety.

SODIUM SULPHIDE has been in better request and is without change in value.

ZINC OXIDE is unchanged.

Pharmaceutical Chemicals

ACETYL SALICYLIC ACID.—Price cutting has been in evidence, the market being lower on the weak.

AMIDOPYRIN.—Lower, due largely to realisation of stocks on which duty has not been paid, and poor export demand.

BARBITONE.—Failure of fresh supplies has fixed the advance.

BROMIDES.—Cut prices have been entertained for second-hand parcels, due doubtless to offers by German dealers, but the quality of many parcels is unreliable.

GUAIACOL.—Carbonate is unchanged. Lower prices are entertained by makers for liquid and crystals.

HYDROQUINONE.—Easier; demand poor.

PHENAZONE.—Weaker.

SODA SALICYLATE.—Unchanged and in better demand.

Coal Tar Intermediates

The position remains practically unchanged during the past week, and a fair number of sales have been made in certain lines.

ALPHA NAPHTHOL continues in short supply, while the price is fully maintained.

ALPHA NAPHTHYLAMINE continues interesting, and the price is unchanged.

BENZIDINE BASE AND SULPHATE.—There has been some demand for home trade.

CROCEINE ACID is quiet.

DIMETHYLANILINE remains unchanged.

DIPHENYLAMINE.—Inquiries have been received for both home and export, the price remaining firm.

NAPHTHIONIC ACID continues to be of interest for home trade.

NAPHTHIONATE OF SODA continues at recent values, with fair business passing.

ORTHONITROTOLUENE is featureless.

PARAPHENYLENEDIAMINE.—Some small business has been placed for export.

RESORCIN.—Some home trade inquiry has been received, and the price remains firm.

Coal Tar Products

There is no great change in values of coal tar products from last week.

90% BENZOL is fairly plentiful at 1s. 6d. per gallon on rails, and a further slight fall in price is not improbable.

PURE BENZOL is quiet, and is worth 1s. 10d. to 2s. per gallon on rails.

CREOSOTE OIL is fairly firm at 8½d. per gallon on rails in the North, and 9½d. to 9½d. per gallon in the South.

CRESYLIC ACID is worth about 2s. 1d. per gallon on rails for the pale quality 97/99%, while the dark quality 95/97% is quoted at 1s. 9d. to 1s. 10d. per gallon on rails.

SOLVENT NAPHTHA is plentiful, and is worth about 1s. 3d. per gallon on rails.

HEAVY NAPHTHA is in poor demand, and is quoted at 1s. 5d. to 1s. 6d. per gallon on rails.

NAPHTHALENES remain inactive, the lower qualities being quoted at £6 to £6 10s. per ton, while the higher qualities 74/76 and 76/78 are quoted at £8 10s. to £9 per ton.

PITCH.—Business is practically at a standstill, and the market displays a somewhat weaker tone. Quotations are nominally: London, 145s. to 150s., f.o.b.; East Coast, 140s. to 145s., f.o.b.

Sulphate of Ammonia

There are no new features to report.

Current Market Prices on following pages.

French Potash

THE market for potash fertilisers shows more activity than usual at this season, but orders are for the most part for autumn delivery. Quotations for crushed salts and for muriate of potash are even keener than they were a few months ago. The downward trend of both the French and German currencies has intensified competition. As the result of these activities buyers are more inclined to purchase on a definite unitary basis in view of the fact that the margin of profit on the richer qualities is greater. Fertiliser manufacturers are procuring stocks of potash manure salts, French sylvinites, and muriate of potash for compound manures on exceptional terms, but there is a general feeling that uniform prices would be more satisfactory for the trade. For the coming autumn fertiliser season it is anticipated that the sale of potash salts such as sylvinites 20 per cent., which can be stored without deterioration, will be greater than in any previous year.

Current Market Prices

General Chemicals

	Per	£	s.	d.	£	s.	d.	
Acetic anhydride, 90-95%.....	lb.	0	1	4	to	0	1	5
Acetone oil.....	ton	90	0	0	to	95	0	0
Acetone, pure.....	ton	122	10	0	to	125	0	0
Acid, Acetic, glacial, 99-100%.....	ton	71	0	0	to	72	0	0
Acetic, 80% pure.....	ton	50	0	0	to	51	0	0
Acetic, 40% pure.....	ton	25	0	0	to	26	0	0
Arsenic, liquid, 2000 s.g.....	ton	88	0	0	to	90	0	0
Boric, commercial.....	ton	50	0	0	to	55	0	0
Carbolic, cryst. 39-40%.....	lb.	0	1	5	to	0	1	5½
Citric.....	lb.	0	1	8	to	0	1	8½
Formic, 80%.....	ton	50	0	0	to	51	0	0
Hydrofluoric.....	lb.	0	0	7½	to	0	0	8½
Lactic, 50 vol.....	ton	36	0	0	to	38	0	0
Lactic, 60 vol.....	ton	42	0	0	to	44	0	0
Nitric, 80 Tw.....	ton	27	0	0	to	28	0	0
Oxalic.....	lb.	0	0	6½	to	0	0	6½
Phosphoric, 1.5.....	ton	35	0	0	to	38	0	0
Pyrogallic, cryst.....	lb.	0	5	9	to	0	6	0
Salicylic, technical.....	lb.	0	1	9	to	0	2	0
Sulphuric, 92-93%.....	ton	6	0	0	to	7	0	0
Tannic, commercial.....	lb.	0	2	3	to	0	2	9
Tartaric.....	lb.	0	1	5	to	0	1	5½
Alum, lump.....	ton	12	10	0	to	13	0	0
Chrome.....	ton	28	0	0	to	29	0	0
Alumino ferric.....	ton	7	0	0	to	7	5	0
Aluminium, sulphate, 14-15%.....	ton	8	10	0	to	9	0	0
Sulphate, 17-18%.....	ton	10	10	0	to	11	0	0
Ammonia, anhydrous.....	lb.	0	1	6	to	0	1	8
880.....	ton	32	0	0	to	34	0	0
920.....	ton	22	0	0	to	24	0	0
Carbonate.....	ton	32	15	0	to	—	—	—
Chloride.....	ton	50	0	0	to	55	0	0
Muriate (galvanisers).....	ton	35	0	0	to	37	10	0
Nitrate (pure).....	ton	35	0	0	to	40	0	0
Phosphate.....	ton	65	0	0	to	68	0	0
Sulphocyanide, commercial 90%.....	lb.	0	1	1	to	0	1	3
Amyl acetate, technical.....	ton	225	0	0	to	260	0	0
Arsenic, white powdered.....	ton	73	0	0	to	75	0	0
Barium, carbonate, Witherite.....	ton	5	0	0	to	6	0	0
Carbonate, Precip.....	ton	15	0	0	to	16	0	0
Chlorate.....	ton	65	0	0	to	70	0	0
Chloride.....	ton	15	10	0	to	16	0	0
Nitrate.....	ton	33	0	0	to	35	0	0
Sulphate, blanc fixe, dry.....	ton	20	10	0	to	21	0	0
Sulphate, blanc fixe, pulp.....	ton	10	5	0	to	10	10	0
Sulphocyanide, 95%.....	lb.	0	0	11	to	0	1	0
Bleaching powder, 35-37%.....	ton	10	7	6	to	10	17	6
Borax crystals.....	ton	27	0	0	to	—	—	—
Calcium acetate, Brown.....	ton	11	10	0	to	12	0	0
Grey.....	ton	19	15	0	to	20	0	0
Carbide.....	ton	16	0	0	to	17	0	0
Chloride.....	ton	5	15	0	to	6	0	0
Carbon bisulphide.....	ton	35	0	0	to	40	0	0
Casein technical.....	ton	100	0	0	to	105	0	0
Cerium oxalate.....	lb.	0	3	0	to	0	3	6
Chromium acetate.....	lb.	0	1	1	to	0	1	3
Cobalt acetate.....	lb.	0	6	0	to	0	6	6
Oxide, black.....	lb.	0	9	6	to	0	10	0
Copper chloride.....	lb.	0	1	1	to	0	1	2
Sulphate.....	ton	27	0	0	to	28	0	0
Cream Tartar, 98-100%.....	ton	90	0	0	to	92	10	0
Epsom salts (see Magnesium sulphate)								
Formaldehyde, 40% vol.....	ton	97	10	0	to	98	0	0
Formosol (Fongalite).....	lb.	0	2	1	to	0	2	2
Glauber salts, commercial.....	ton	4	10	0	to	5	0	0
Glycerin crude.....	ton	65	0	0	to	67	10	0
Hydrogen peroxide, 12 vols.....	gal	0	2	2	to	0	2	3
Iron perchloride.....	ton	18	0	0	to	20	0	0
Sulphate (Copperas).....	ton	3	10	0	to	4	0	0
Lead acetate, white.....	ton	43	0	0	to	45	0	0
Carbonate (White Lead).....	ton	43	0	0	to	45	0	0
Nitrate.....	ton	44	10	0	to	45	0	0
Litharge.....	ton	37	0	0	to	39	0	0
Lithophone, 30%.....	ton	22	10	0	to	23	0	0
Magnesium chloride.....	ton	4	5	0	to	4	10	0
Carbonate, light.....	cwt.	2	10	0	to	2	15	0
Sulphate (Epsom salts commercial).....	ton	6	10	0	to	7	0	0
Sulphate (Druggists').....	ton	10	0	0	to	11	0	0
Manganese Borate, commercial.....	ton	65	0	0	to	75	0	0
Sulphate.....	ton	45	0	0	to	50	0	0
Methyl acetone.....	ton	78	0	0	to	80	0	0
Alcohol, 1% acetone.....	ton	105	0	0	to	110	0	0
Nickel sulphate, single salt.....	ton	38	0	0	to	39	0	0
Ammonium sulphate, double salt.....	ton	38	0	0	to	39	0	0

	Per	£	s.	d.	£	s.	d.	
Potash, Caustic.....	ton	35	0	0	to	36	0	0
Potassium bichromate.....	lb.	0	0	5½	to	0	0	6
Carbonate, 90%.....	ton	31	0	0	to	32	0	0
Chloride, 80%.....	ton	9	0	0	to	10	0	0
Chlorate.....	lb.	0	0	3½	to	—	—	—
Metabisulphite, 50-52%.....	ton	65	0	0	to	70	0	0
Nitrate, refined.....	ton	38	0	0	to	40	0	0
Permanganate.....	lb.	0	0	10	to	0	0	10½
Prussiate, red.....	lb.	0	3	0	to	0	3	2
Prussiate, yellow.....	lb.	0	1	3	to	0	1	3½
Sulphate, 90%.....	ton	10	10	0	to	11	0	0
Salammoniac, firsts.....	cwt.	3	3	0	to	—	—	—
Seconds.....	cwt.	3	0	0	to	—	—	—
Sodium acetate.....	ton	25	0	0	to	25	10	0
Arsenate, 45%.....	ton	45	0	0	to	48	0	0
Bicarbonate.....	ton	10	10	0	to	11	0	0
Bichromate.....	lb.	0	0	4½	to	0	0	4½
Bisulphite, 60-62%.....	ton	21	0	0	to	23	0	0
Chlorate.....	lb.	0	0	3	to	0	0	3½
Caustic, 70%.....	ton	19	10	0	to	20	0	0
Caustic, 76%.....	ton	20	10	0	to	21	0	0
Hydrosulphite, powder.....	lb.	0	1	5	to	0	1	6
Hyposulphite, commercial.....	ton	10	10	0	to	11	0	0
Nitrite, 96-98%.....	ton	27	10	0	to	28	0	0
Phosphate, crystal.....	ton	16	0	0	to	16	10	0
Perborate.....	lb.	0	1	0	to	0	1	1
Prussiate.....	lb.	0	0	6½	to	0	0	7
Sulphide, crystals.....	ton	8	10	0	to	9	0	0
Sulphide, solid, 60-62 %.....	ton	14	10	0	to	15	10	0
Sulphite, cryst.....	ton	11	10	0	to	12	0	0
Strontium carbonate.....	ton	50	0	0	to	55	0	0
Nitrate.....	ton	50	0	0	to	55	0	0
Sulphate, white.....	ton	6	10	0	to	7	10	0
Sulphur chloride.....	ton	25	0	0	to	27	10	0
Flowers.....	ton	11	0	0	to	11	10	0
Roll.....	ton	9	15	0	to	10	10	0
Tartar emetic.....	lb.	0	1	2	to	0	1	3
Tin perchloride, 33%.....	lb.	0	1	1	to	0	1	2
Perchloride, solid.....	lb.	0	1	3	to	0	1	4
Protochloride (tin crystals).....	lb.	0	1	4	to	0	1	5
Zinc chloride 102° Tw.....	ton	20	0	0	to	21	0	0
Chloride, solid, 96-98%.....	ton	25	0	0	to	30	0	0
Oxide, 99%.....	ton	42	0	0	to	45	0	0
Dust, 90%.....	ton	50	0	0	to	55	0	0
Sulphate.....	ton	15	0	0	to	16	0	0

Pharmaceutical Chemicals

Acetyl salicylic acid.....	lb.	0	3	0	to	0	3	3
Acetanilid.....	lb.	0	1	6	to	0	1	9
Acid, Gallic, pure.....	lb.	0	3	0	to	0	3	3
Lactic, 1.21.....	lb.	0	2	0	to	0	2	6
Salicylic, B.P.....	lb.	0	2	0	to	0	2	3
Tannic, leviss.....	lb.	0	3	3	to	0	3	6
Amidol.....	lb.	0	7	9	to	0	8	3
Amidopyrin.....	lb.	0	12	0	to	0	12	6
Ammon ichthosulphonate.....	lb.	0	1	10	to	0	2	0
Barbitone.....	lb.	1	0	0	to	1	2	0
Beta naphthol resublimed.....	lb.	0	1	9	to	0	2	0
Bromide of ammonia.....	lb.	0	0	7	to	0	0	7½
Potash.....	lb.	0	0	6	to	0	0	6½
Soda.....	lb.	0	0	7	to	0	0	7½
Caffeine, pure.....	lb.	0	10	9	to	0	11	0
Calcium glycerophosphate.....	lb.	0	5	9	to	0	6	0
Lactate.....	lb.	0	1	10	to	0	2	0
Calomel.....	lb.	0	4	9	to	0	5	0
Chloral hydrate.....	lb.	0	3	10½	to	0	4	0
Cocaine alkaloid.....	oz.	0	17	3	to	0	17	9
Hydrochloride.....	oz.	0	14	6	to	0	15	0
Corrosive sublimate.....	lb.	0	4	0	to	0	4	3
Eucalyptus oil, B.P. (70-75% eucalyptol).....	lb.	0	1	10	to	0	1	11
B.P. (75-80% eucalyptol).....	lb.	0	1	11	to	0	2	0
Guaiacol carbonate.....	lb.	0	8	3	to	0	8	6
Liquid.....	lb.	0	8	9	to	0	9	3
Pure crystals.....	lb.	0	9	3	to	0	9	9
Hexamine.....	lb.	0	3	10	to	0	4	0
Hydroquinone.....	lb.	0	3	3	to	0	3	6
Lanoline anhydrous.....	lb.	0	0	7	to	0	0	7½
Lecithin ex ovo.....	lb.	0	17	6	to	0	19	0
Lithi carbonate.....	lb.	0	9	6	to	0	10	0
Methyl salicylate.....	lb.	0	2	3	to	0	2	6
Metol.....	lb.	0	9	6	to	0	10	6
Milk sugar.....	cwt.	4	2	6	to	4	5	0
Paraldehyde.....	lb.	0	1	6	to	0	1	9
Phenacetin.....	lb.	0	6	0	to	0	6	3
Phenazone.....	lb.	0	7	0	to	0	7	3
Phenolphthalein.....	lb.	0	6	9	to	0	7	0
Potassium sulpho guaiacolate.....	lb.	0	5	0	to	0	5	3
Quinine sulphate, B.P.....	oz.	0	2	3	to	—	—	—

	Per	£	s.	d.	£	s.	d.
Resorcin, medicinal.....lb.	0	5	6	to	0	5	9
Salicylate of soda powder.....lb.	0	2	6	to	0	2	9
Crystals.....lb.	0	2	9	to	0	3	0
Salol.....lb.	0	2	9	to	0	3	0
Soda Benzoate.....lb.	0	2	6	to	0	2	9
Sulphonol.....lb.	0	14	6	to	0	15	0
Terpene hydrate.....lb.	0	1	9	to	0	2	0
Theobromine, pure.....lb.	0	10	6	to	0	11	0
Soda salicylate.....lb.	0	7	9	to	0	8	0
Vanillin.....lb.	1	3	0	to	1	4	0

Coal Tar Intermediates, &c.

Alphanaphthol, crude.....lb.	0	2	0	to	0	2	3
Refined.....lb.	0	2	6	to	0	2	9
Alphanaphthylamine.....lb.	0	1	6	to	0	1	7
Aniline oil, drums extra.....lb.	0	0	9	to	0	0	9½
Salts.....lb.	0	0	9½	to	0	0	10
Anthracene, 40-50%.....unit	0	0	8½	to	0	0	9
Benzaldehyde (free of chlorine).....lb.	0	2	6	to	0	2	9
Benzidine, base.....lb.	0	4	9	to	0	5	0
Sulphate.....lb.	0	3	9	to	0	4	0
Benzoic acid.....lb.	0	2	0	to	0	2	3
Benzyl chloride, technical.....lb.	0	2	0	to	0	2	3
Betanaphthol.....lb.	0	1	1	to	0	1	2
Betanaphthylamine, technical.....lb.	0	4	0	to	0	4	3
Croceine Acid, 100% basis.....lb.	0	3	3	to	0	3	6
Dichlorobenzol.....lb.	0	0	9	to	0	0	10
Diethylaniline.....lb.	0	4	6	to	0	4	9
Dinitrobenzol.....lb.	0	1	1	to	0	1	2
Dinitrochlorbenzol.....lb.	0	0	11	to	0	1	0
Dinitronaphthalene.....lb.	0	1	4	to	0	1	5
Dinitrotoluol.....lb.	0	1	4	to	0	1	5
Dinitrophenol.....lb.	0	1	6	to	0	1	7
Dimethylaniline.....lb.	0	2	9	to	0	3	0
Diphenylamine.....lb.	0	3	6	to	0	3	9
H-Acid.....lb.	0	5	0	to	0	5	3
Metaphenylenediamine.....lb.	0	4	0	to	0	4	3
Monochlorbenzol.....lb.	0	0	10	to	0	1	0
Metanilic Acid.....lb.	0	5	9	to	0	6	0
Metatoluylenediamine.....lb.	0	4	0	to	0	4	3
Monosulphonic Acid (2.7).....lb.	0	8	6	to	0	9	6
Naphthionic acid, crude.....lb.	0	2	3	to	0	2	6
Naphthionate of Soda.....lb.	0	2	5	to	0	2	6
Naphthylamin-di-sulphonic acid.....lb.	0	4	0	to	0	4	3
Nevill Winther Acid.....lb.	0	7	3	to	0	7	9
Nitrobenzol.....lb.	0	0	7	to	0	0	8
Nitronaphthalene.....lb.	0	0	11½	to	0	1	0
Nitrotoluol.....lb.	0	0	8	to	0	0	9
Orthoamidophenol base.....lb.	0	12	0	to	0	12	6
Orthodichlorbenzol.....lb.	0	1	0	to	0	1	1
Orthotoluidine.....lb.	0	0	10	to	0	0	11
Orthonitrotoluol.....lb.	0	0	3	to	0	0	4
Para-amidophenol, base.....lb.	0	8	6	to	0	9	0
Hydrochlor.....lb.	0	7	6	to	0	8	0
Paradichlorbenzol.....lb.	0	0	6	to	0	0	7
Paranitraniline.....lb.	0	2	7	to	0	2	9
Paranitrophenol.....lb.	0	2	3	to	0	2	6
Paranitrotoluol.....lb.	0	2	9	to	0	3	0
Paraphenylenediamine, distilled.....lb.	0	12	0	to	0	12	6
Paratoluidine.....lb.	0	5	6	to	0	5	9
Phthalic anhydride.....lb.	0	2	6	to	0	2	9
Resorcin, technical.....lb.	0	4	0	to	0	4	3
Sulphanilic acid, crude.....lb.	0	0	10	to	0	0	11
Tolidine, base.....lb.	0	7	3	to	0	7	9
Mixture.....lb.	0	2	6	to	0	2	9

Essential Oils and Synthetics

	ESSENTIAL OILS.	£	s.	d.
Anise.....c.i.f. 1/9 spot		0	1	11
Bay.....		0	12	0
Bergamot.....		0	12	0
Cajaput.....		0	3	6
Camphor, white.....per cwt.		4	0	0
Brown.....		3	15	0
Cassia.....c.i.f. 10/- spot		0	12	0
Cedarwood.....		0	1	4½
Citronella (Ceylon).....Forward position 3s. 2d. c.i.f.		0	3	6
(Java)....." " 3s. 10d. c.i.f.		0	4	2
Clove.....		0	7	6
Eucalyptus.....dearer, very firm		0	1	11
Geranium Bourbon.....		1	10	0
Lavender.....		0	12	6
Lavender spike.....		0	3	0
Lemon.....		0	3	0
Lemongrass.....per oz.		0	0	2½

Lime (distilled).....	£	s.	d.
Orange sweet (Sicilian).....	0	4	0
(West Indian).....	0	13	6
Palmarosa.....	0	10	6
Peppermint (American).....	1	0	0
Mint (dementolised Japanese). Jan.-Feb. shipments 6s.	0	13	0
Patchouli.....	0	7	0
Otto of Rose.....very firm, per oz.	1	12	0
Rosemary.....	1	8	0
Sandalwood.....	0	1	8
Sassafras.....	1	6	0
Thyme.....2/6 to	0	5	6
	0	8	0

SYNTHETICS.

Benzyl acetate.....	0	3	0
Benzoate.....	0	3	0
Citral.....	0	10	0
Coumarine.....	0	18	6
Heliotropine.....	0	7	6
Ionone.....	1	5	0
Linalyl acetate.....	1	2	6
Methyl salicylate.....	0	2	6
Musk xylol.....	0	10	9
Terpeniol.....	0	3	0

Chemical Trade in July

Sir S. W. Royse and Co.'s Monthly Review

DURING July business has been quiet and there is a growing feeling that no considerable improvement in trade can be expected until a satisfactory settlement of the European situation is arrived at. Serious inconvenience has been caused by the dockers' strike, which has lasted the greater part of the month. Prices have on the whole remained steady, though some imported articles have advanced, through restriction of supplies. Sulphate of copper has remained firm; there has been some little inquiry for export, but the shipping season is now over. The Board of Trade returns show 3,282 tons shipped last month as against 4,682 tons for June, 1922, making a total of 37,062 tons for the six months as against 35,063 tons for January-June, 1922. Some allowance, however, must be made for the inclusion in this year's figures of the shipments to the Irish Free State. Green copperas has been in steady request. There is no change to report in acetates of lime, which are still scarce and dear, whilst acetic acid continues firm. Acetates of soda and lead have been in short supply with the holding up of shipments and values have been well maintained. Nitrate of lead is dull. Carbonate of potash and caustic potash have been in rather better inquiry and prices firm. Increased receipts of Montreal potashes have resulted in lower values. Yellow prussiates of potash and soda continue in poor demand, but prices have been steadier with the pressure to realise stocks. White powdered arsenic is still only available in small lots and trade has been normal. Tartaric acid has been in better request through the change in climatic conditions, leading to a clearance of stocks both here and abroad. Citric acid also has been affected and is realising better prices. Cream of tartar has been selling freely, but supplies are ample. Business in bichromates has been confined to British makes. Chlorates are unchanged, but nitrite of soda is scarce. Borax and boracic acid have been in steady request, especially for the B.P. qualities. Oxalic acid has continued dull. There is no change to report in alum and sulphate of alumina. Bleaching powder and white caustic soda have been in moderate demand for the home trade, but there has been a fair inquiry for export. In tar products little change can be reported. Benzols and toluols remained steady and without much demand during the first part of the month, but lower prices are expected owing to the recent reduction in the price of petrol. Solvent naphtha continues in limited request; business is keenly competed for and lower values are quoted. Creosote remains fairly steady. Crude carbolic acid continues firm. There is a fair demand for dehydrated tar without alteration in price. Naphthalenes, if anything, are slightly lower. The pitch market has an easier tendency, but actual business passing is reported small; Continental consumers' ideas of price differ very considerably from those of the distillers.

Scottish Chemical Market

The following notes on the Scottish Chemical Market are specially supplied to THE CHEMICAL AGE by Messrs. Charles Tennant and Co., Ltd., Glasgow, and may be accepted as representing the firm's independent and impartial opinions.

Glasgow, August 1, 1923.

THERE has been a slightly busier tone in the heavy chemical market during the past week, but the amount of business put through still leaves much to be desired.

Offers from the Continent continue to be received and prices named therein are inclined to be higher. Prices of British manufactured chemicals are steady.

Industrial Chemicals

ACID, ACETIC.—Glacial 98/100%, £60 to £62 per ton. 80% pure, £50 to £51 per ton; 80% technical, £47 to £48 per ton, c.i.f. U.K. ports, duty free. Spot lots of this material are rather difficult to obtain at present.

ACID, BORACIC.—Crystal or granulated, £50 per ton; powdered, £52 per ton, carriage paid U.K. stations, minimum ton lots.

ACID, CARBOLIC.—Ice crystals, inclined to be higher at 1s. 2½d. to 1s. 3d. per lb., delivered.

ACID, FORMIC, 80%.—Still available at £50 per ton ex wharf, spot delivery.

ACID, HYDROCHLORIC.—Maker's price unchanged. 6s. 6d. per carboy, ex works.

ACID, NITRIC 80%.—£24 per ton, ex station, full truck loads.

ACID, OXALIC.—Unchanged at about 6d. per lb. ex store.

ACID, SULPHURIC.—144°, £3 15s. per ton; 168°, £7 per ton, ex works, full truck loads. De-arsenicated quality, 20s. per ton extra.

ACID, TARTARIC.—Spot lots on offer at 1s. 2½d. per lb., less 5% ex store.

ALUM, LUMP POTASH.—Spot lots about £11 5s. per ton, ex store.

ALUM, CHROME.—Offered at £22 to £23 per ton, according to quality, f.o.b. U.K. ports.

ALUMINA SULPHATE.—17/18%, £10 15s. per ton; 14/15%, £7 15s. per ton, ex wharf, early delivery.

AMMONIA, ANHYDROUS.—Unchanged at 1s. 5d. per lb., ex station.

AMMONIA, CARBONATE.—Lump 4d. per lb.; ground 4½d. per lb. delivered.

AMMONIA, LIQUID, 88°.—Unchanged at about 3½d. per lb., ex station, containers extra.

AMMONIA, MURIATE.—Grey galvanisers' quality about £31 to £32 per ton; fine white crystals, £24 per ton ex wharf, early delivery.

AMMONIA, SULPHATE.—25¼%, £13 2s. per ton; 25½% neutral quality, £14 5s. per ton, ex works, prompt delivery.

ARSENIC, WHITE POWDERED.—Moderate inquiry for small quantities, prices remain unchanged at about £76 10s. per ton, ex wharf, spot delivery.

BARIUM CHLORIDE, 98/100%.—Continental material quoted £12 15s. per ton, c.i.f. U.K. port, early delivery.

BARYTES.—Finest white English, £5 5s. per ton, ex works.

BLEACHING POWDER.—£11 7s. 6d. per ton, ex station, spot delivery. Contracts 20s. per ton less.

BORAX.—Granulated, £26 10s. per ton; crystal, £27 per ton; powdered, £28 per ton, carriage paid U.K. Stations, minimum ton lots.

CALCIUM CHLORIDE.—English make unchanged at £5 12s. 6d. per ton, ex quay or station. Continental material about £4 per ton, c.i.f. U.K.

COPPERAS, GREEN.—About £2 2s. 6d. per ton, f.o.b. U.K. port.

FORMALDEHYDE, 40%.—Spot lots offered here to obtain price about £93 10s. per ton, ex wharf. Offered for early shipment from Continent at about £88 per ton ex wharf.

GLAUBER SALTS.—Fine white crystals, quoted £3 15s. per ton, ex store.

LEAD, RED.—English makers reduce price to £40 per ton, carriage paid U.K. stations. Continental material about £36 10s. per ton, ex store.

LEAD, WHITE.—Offered from Continent at £36 per ton, c.i.f. U.K. ports.

LEAD, ACETATE.—Spot material scarce. Offered from Continent at £42 per ton, c.i.f. U.K., prompt shipment.

MAGNESITE, GROUND CALCINED.—English burnt material. £8 5s. per ton, ex station; finest Continental about £7 5s. per ton, c.i.f. U.K. ports.

MAGNESIUM CHLORIDE.—Continental material unchanged at 32s. 6d. per ton, c.i.f. U.K. ports. Spot lots £2 15s. per ton, ex store.

MAGNESIUM SULPHATE (EPSOM SALTS).—Commercial quality, £7 per ton; B.P. quality, £8 5s. per ton, ex station. Continental commercial crystals quoted £4 per ton, ex store.

POTASH, CAUSTIC.—88/92% offered at £29 15s. per ton, c.i.f. U.K. ports, spot lots about £33 per ton, ex store.

POTASSIUM BICHROMATE.—Unchanged at 5½d. per lb. delivered.

POTASSIUM CARBONATE.—96/98% offered at £28 10s. per ton, c.i.f. U.K., spot lots about £32 10s. per ton ex store. 90/92% offered at £27 per ton, c.i.f. U.K., spot lots about £28 5s. per ton, ex store.

POTASSIUM CHLORATE.—Unchanged at about 3d. per lb. ex store.

POTASSIUM NITRATE (SALTPETRE).—Nominally £32 per ton, ex store.

POTASSIUM PERMANGANATE.—B.P. Crystals inclined to be higher at about 10½d. per lb. delivered.

POTASSIUM PRUSSIAN (YELLOW).—Remains unchanged at about 1s. 3½d. per lb. ex store.

SODA, CAUSTIC.—76/77%, £21 7s. 6d. per ton; 70/72%, £19 17s. 6d. per ton; 60/62%, broken, £21 2s. 6d. per ton; 98/99%, powdered, £24 15s. per ton. All ex station, spot delivery.

SODIUM ACETATE.—Spot lots difficult to obtain. Prices round about £26 per ton, ex wharf.

SODIUM BICARBONATE.—Refined recrystallised quality, £10 10s. per ton, ex quay or station, M.W. quality, 30s. per ton less.

SODIUM BICHROMATE.—Unchanged at 4½d. per lb., delivered.

SODIUM CARBONATE.—(Soda Crystals) £5 to £5 5s. per ton, ex quay or station. (Alkali 58%) £8 16s. per ton, ex quay or station.

SODIUM HYPOSULPHITE.—Continental commercial crystals now offered at £7 15s. per ton c.i.f. U.K. Spot lots about £9 10s. per ton ex store. Pea crystals £15 10s. per ton ex store.

SODIUM NITRITE.—Refined, 96/98%, about £13 7s. 6d. per ton, f.o.r. or f.o.b., U.K. port.

SODIUM NITRATE.—Continental material testing about 96/98% quoted £26 5s. per ton, ex store.

SODIUM PRUSSIAN (YELLOW).—Unchanged at about 7d. per lb., ex store; in little demand.

SODIUM SULPHATE (SALTCAKE).—Unchanged at £4 per ton, ex station, for home consumption. Higher prices for export.

SODIUM SULPHIDE, 60/62% Solid.—Continental material unchanged at about £12 10s. per ton c.i.f. U.K. Broken quality £1 per ton more.

SULPHUR.—Flowers, £10 per ton; Roll, £9 per ton; Rock, £9 per ton; Ground, £8 per ton. Prices nominal.

TIN, CRYSTALS.—Unchanged at 1s. 4d. per lb.

ZINC, CHLORIDE.—English material about £25 per ton. Continental material about £23 per ton c.i.f. U.K. ports.

ZINC, SULPHATE.—Spot lots of Continental material on offer at £11 5s. per ton, ex store.

NOTE.—The above prices are for bulk business and are not to be taken as applicable to small parcels.

Coal Tar Intermediates and Wood Distillation Products

ANILINE OIL, PURE.—Several export inquiries. Price, 10½d. per lb. f.o.b., drums included.

ANTHRAQUINONE.—Export and home inquiry. Price 2s. 6d. per lb., f.o.b., or carriage paid.

BENZIDINE BASE.—Export inquiry. Price quoted 5s. per lb., 100% basis, f.o.b.

BENZOIC ACID.—Supplies are offered at 2s. per lb., carriage paid.

BETA NAPHTHOL.—Home and export inquiries. Price quoted 1s. 1d. lb. carriage paid or f.o.b.
 DINITRO BENZOL.—Export inquiry. Price quoted, 1s. 3d. per lb.
 ETHYL BENZYL ANILINE.—Small home inquiry. Price quoted 7s. 6d. per lb., delivered.
 GAMMA ACID.—Small export inquiry. Price 12s. 7d. per lb., 100 per cent. basis, f.o.b.
 "H" ACID.—Home and export inquiries. Price quoted 5s. 1b. 100% basis carriage paid or f.o.b.
 MONO ETHYL ANILINE.—Home inquiry. Price quoted 4s. 9d. lb., delivered, drums returnable.
 METAPHENYLENEDIAMINE.—Export inquiry. Price quoted 5s. 2d. per lb. 100% basis, f.o.b.
 METANITRANILINE.—Export inquiry. Price quoted 5s. 6d. per lb., f.o.b.
 METATOLULENEDIAMINE.—Export inquiry. Price quoted 4s. 2d. per lb., delivered.
 ORTHONITROTOLUOL.—Supplies are offered at 4d. per lb., carriage paid.
 PARANITRANILINE.—Export inquiry. Price quoted 2s. 7d. per lb., f.o.b.
 PARA AMIDOPHENOL, BASE.—Some demand. Price 7s. 9d. per lb. 100% basis, delivered.
 XYLIDINE.—Home inquiry. Price quoted 7s. 9d. per lb. delivered.

Japan's Production of Alcohol

The production of alcohol during 1922 is officially reported to have amounted to 16,353,180 litres, as compared with 13,072,860 litres and 9,778,424 litres in 1921 and 1920 respectively. The official estimate of the 1923 production is 19,800,000 litres, but it is considered that this estimate may not in fact be realised. An agreement was arrived at by the mill owners in Formosa last autumn under which a limit was placed on shipments of alcohol to Japan, in order to maintain prices, and the limit in question has been stated to be approximately 8 million litres. There is, however, no restriction placed on exports to foreign countries, and the mills are accordingly endeavouring to increase their markets abroad. The price obtained f.o.b. during June for alcohol shipped to Japan was 13 yen per case of 36 litres, whilst for cases shipped abroad the price secured was 9.50 yen per case. These prices are approximately 25 per cent. higher than those prevailing at the beginning of the year. Since July 1, 1922, alcohol has been a Government monopoly in Formosa, the manufacture, as well as the distribution and sale, being forbidden except under Government licence. Under the Ordinance establishing the monopoly there is a tax on alcohol for domestic consumption of 1.50 yen per degree per koku (180 litres), equivalent, at 94 degs. per koku, to 141 yen per koku. This tax, however, is remitted in the case of exports to foreign countries.

Alcohol from Horse Chestnuts

MR. JUSTICE ROWER, in the Chancery Division, London, on Friday, July 27, had before him an action by Mr. William Watson, of Dundee, dyer and finisher, to recover from the Organic Research Co., Ltd., which was incorporated in London in 1919, and Mr. William Alfred Bromwich, of Camden Town, London, £2,000 which he had paid for shares in the company, and rescission of any agreement he had made to take the shares. Mr. J. H. Cunliffe, K.C., who appeared for the plaintiff, said while Watson was staying at Newquay, Cornwall, in 1921, he became acquainted with Mr. Bromwich, who was interested in companies formed for the exploitation of chemical processes and inventions. Mr. Bromwich later introduced the defendant company to him. It was formed with a capital of £21,000 to exploit patented processes for producing alcohol and acetone from cheap starchy substances such as horse chestnuts. Mr. Bromwich said there were only 4,000 shares unissued, that Nobel Industries, Ltd., wanted to get hold of them, and that the plaintiff's only chance of getting 2,000 shares was to apply at once. Plaintiff sent a cheque to the company, expecting to get new shares, but what he received was a transfer, which he refused to sign. The company had since gone into voluntary liquidation. The defence, said counsel, was that Mr. Bromwich told plaintiff that he was the owner of the shares. The plaintiff, however, denied that.

Manchester Chemical Market

(FROM OUR OWN CORRESPONDENT.)

Manchester, August 2, 1923.

CHEMICAL traders here are unable to report any improvement in the demand for chemicals, either for home or export, and the condition of things is decidedly dull. For domestic consumption buyers are still inclined to satisfy no more than immediate needs, while on foreign trade account continental business is very quiet, the bulk of the shipments being to the Colonies. Prices, on the whole, keep up fairly well, and in some cases are particularly firm on scarcity of parcels for spot or early delivery.

Heavy Chemicals

Hyposulphite of soda is about unchanged at £14 per ton for photographic crystals and £10 for commercial, the demand being very inactive. The same may be said of sodium sulphide, with 60-65 per cent. concentrated solid quoted at £14 10s. to £15 and crystals at about £8 10s. per ton. Glauber salts are quiet but steady at £4 to £4 5s. per ton. Caustic soda is firm at £19 for 60 per cent. and £21 10s. per ton for 76-77 per cent. material, a fair inquiry being met with both from home and foreign users. Bleaching powder meets with a moderate demand at £11 7s. 6d. per ton to home consumers. Soda crystals are steady and fairly active at £5 5s. per ton delivered. A rather good foreign demand for saltcake is reported, though domestic consumers are restricting their purchases; prices are unchanged at around £4 10s. per ton. Bicarbonate of soda keeps steady at £10 10s. per ton delivered to home users. Both home and export demand for alkali keeps up, and prices are maintained at £7 12s. 6d. per ton for 58 per cent. material. Phosphate of soda is quiet at £14 10s. to £15 per ton. Nitrite of soda continues in rather short supply, and prices are very firm at £26 10s. to £27 per ton. Chlorate of soda is in moderate inquiry at 2½d. per lb. Prussiate of soda still fails to arouse much buying interest, and price, though weak, keeps round 6½d. per lb. Acetate of soda is scarce and firm at £25 per ton. Bichromate is in fair demand at 4½d. per lb.

Caustic potash is firm and moderately active at £29 per ton for 88-90 per cent. material, with carbonate of potash in much the same position at £31 per ton for 96-98 per cent. and £28 for 90-92 per cent. Yellow prussiate of potash is still a dull section, and prices are easy at 1s. 2½d. to 1s. 2½d. per lb. Bichromate of potash is firm and in fair demand at 5½d. per lb. Permanganate of potash is rather quiet at 9½d. per lb. Chlorate of potash keeps steady at round 3d. per lb.

Only a quiet export demand for sulphate of copper is being received and quotations are round £26 per ton f.o.b. Although the foreign inquiry for arsenic is less pressing, supplies are short and prices are maintained at about £73 per ton for white-powdered Cornish makes. Commercial Epsom salts are steady and in moderate demand at £4 to £4 10s. per ton, with magnesium sulphate, B.P., on offer at £6. Nitrate of lead keeps quiet but firm at £42 per ton. Supplies of acetate of lime are still on the short side, and prices are steady at £21 for grey and £11 per ton for brown. Sugar of lead is well maintained at round £42 per ton both for white and brown.

Acids and Tar Products

Tartaric and citric acids have been in rather better demand, tartaric at 1s. 3d., and citric, B.P. crystals, at 1s. 8½d. per lb. Acetic acid is very firm and in steady demand at £70 per ton for glacial and £48 per ton for 80 per cent. technical. Oxalic acid is very quiet at round 6d. per lb.

A fair amount of inquiry for pitch is coming in and prices range between £7 and £7 10s. per ton f.o.b. Carbolie acid is steady at 1s. 2d. per lb. for crystals and round 3s. 2d. per gallon for crude. Benzol keeps firm at 1s. 7d. to 1s. 8d. per gallon. Naphthalene prices are unchanged from last week's level, flake being on offer at about £20 and crude at £7 to £13 per ton according to grade. A moderate amount of business is being done in creosote oil at 8½d. to 9d. per gallon.

Company News

ARIZONA COPPER CO.—An interim dividend at the rate of 1s. per share, free of tax, will be paid on November 1 next.

"SENTINEL" WAGGON WORKS, LTD.—The directors have authorised payment of the usual interim dividend on the $7\frac{1}{2}$ per cent. cumulative participating preference shares. Dividend warrants will be posted on August 31.

CONSETT SPANISH ORE CO., LTD.—A final dividend at the rate of 1s. per share is announced, payable on August 16 next. The ordinary general meeting of the company will be held at 118, Pilgrim Street, Newcastle, on Thursday, August 9.

TARMAC, LTD.—The directors have declared an interim dividend at the rate of $7\frac{1}{2}$ per cent., which compares with 10 per cent. last year. The transfer books are closed until August 11, for preparation of the interim dividend warrants.

W. AND H. M. GOULDING, LTD.—The net profits for the year ended June 30 last amounted to £35,139 (against £50,360 for the preceding year). The usual sum of £7,000 is set aside to cover estimated discounts on realisation of outstanding debts, and with £7,940 brought forward, the available sum of distribution is £36,079. The dividend for the year on the ordinary shares is 5 per cent., less tax, and a sum of £5,000 is carried to depreciation account, while a balance of £3,904 is carried forward.

Chemical Trade Inquiries

The following inquiries, abstracted from the "Board of Trade Journal," have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1. British firms may obtain the names and addresses of the inquirers by applying to the Department (quoting the reference number and country), except where otherwise stated.

LOCALITY OF FIRM OR AGENT.	MATERIAL.	REF. NO.
Australia	Surgical dressings, drugs, and chemists' sundries.	—

Tariff Changes

ZANZIBAR.—A notice dated June 18 states that ground nuts and salt may be imported into Zanzibar free from Customs duty.

FRANCE.—A Law, dated July 16, has the effect of removing the "coefficient of increase" of 2.5 which was formerly applied to the import duties on crude iodine so that this article is now dutiable at 1,600 and 400 francs per 100 kilogs. under the "General" and "Minimum" Tariffs respectively, without the application of any "co-efficient."

Contracts Open

Tenders are invited for the following articles. The latest dates for receiving tenders are, when available, given in parentheses:

BUENOS AIRES.—Chemicals, fuel oil, disinfectants, paints and varnishes, etc. Particulars from the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1. Reference No. 8,495/F.L./G.P.

JOHANNESBURG (AUGUST 27).—Aluminium paint. A complete copy of the tender form, specification, etc., can be seen on application to the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1. Reference No. 11,706/E.D./C.C./2.

LONDON (AUGUST 10).—Red and white lead. Particulars from Mr. E. A. Neville, managing director, Bengal and North Western Railway Co., Ltd., 237, Gresham House, Old Broad Street, London, E.C.2.

Chemical Engineering Courses

THE New Courses in chemical engineering, etc., arranged by the University of Michigan are described in an interesting pamphlet, copies of which may be obtained on application to Professor A. H. White, Professor of Chemical Engineering, University of Michigan, Ann Arbor, Michigan, U.S.A.

Catalogues Received

ALBRO FILLERS AND ENGINEERING CO., LTD.—Albro fillers are simple and ingenious devices made under Alison Broadhurst patents, for automatically filling containers with liquids or semi-liquids for sale and dispatch. Descriptive literature is available from 34, Holloway Road, London, N.7.

LIONEL ROBINSON AND CO.—We have received from this firm of electrical engineers a leaflet describing the "Ella" rotary converter, for charging accumulators from D.C. circuits. Voltmeters and other electrical accessories are described in the same leaflet which may be obtained from their office at 3, Staple Inn, London, W.C.1.

THE DURASTIC BITUMINOUS PAINT CO., LTD.—The above firm, of 1, Central Buildings, Westminster, S.W.1, issue a leaflet describing "Durastic" bituminous paint, which is a preparation for coating iron, steel, etc., for the prevention of rust and corrosion. The cost of this preparation is less than that of paint, and it is stated to be very much more durable.

THOS. HILL-JONES, LTD.—An excellently produced illustrated 40-page brochure published by this firm, of Invicta Works, Bow Common Lane, London, E.3, describes the properties and use of "Invicta" bitumen, which is a carefully standardised bitumen for road-surfacing work, of extremely good binding power with corresponding wearing properties.

ALBERT E. HARRIS.—Dust-collecting and extracting apparatus for all industries is the speciality of Albert E. Harris, 19, Russell Square, London, and in a 24-page brochure received from the firm numerous diagrams and photographs are shown, including plant for zinc oxide recovery, phosphate dust, cement dust, plant for use in briquetting works, carbide works, and so on.

SUN LANE ENGINEERING WORKS.—The Hurrell Homogeniser, which is produced by this firm, is described in an 8-page booklet issued from their works at Blackheath, London, S.E.3. The machine is a rotary disintegrator, applicable for use with a wide range of liquids, semi-solids, etc., such as in paint manufacture or the purification of certain organic chemicals, especially those of a gummy nature. The Homogeniser is stated to have special advantages in the way of easy control, cleaning and installation.

A Booklet on Technical Advertising

THE booklet on technical advertising, issued by the Technical Advertising Service (Mr. Bertram Ward, B.Sc., A.I.C., and Mr. W. K. Crampton Chalk), is a good example of intelligent approach to the problem of specialised publicity. Quoting an appropriate passage from Lavoisier, the authors, who are chemists themselves, explain their methods of placing chemical and similar products "in the right way before the right potential buyers." The case is well put, without extravagance; the letterpress is excellent, and the examples of good and bad ways of presenting trade announcements are, perhaps, most convincing of all.

Chemicals for Argentina

THE Commercial Secretary at Buenos Aires (Mr. H. O. Chalkley) has informed the Department of Overseas Trade by cable that the State Railways are calling for tenders, to be delivered on various dates between the 10th September and 3rd October, for material for next year's stores. The materials required include disinfectants, fuel oil, chemicals, foundry materials, glass, paints and varnishes. Interested United Kingdom firms should apply to the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1, quoting Reference 8495/F.L./G.P.

Photographic Materials for South America

A CONFIDENTIAL memorandum of information regarding the market for photographic materials in the State of Rio de Janeiro has been issued by the Department of Overseas Trade, 35, Old Queen Street, Westminster, S.W.1, and copies may be obtained by United Kingdom firms interested upon application to Mr. Darbyshire (Room 53).

THE BRITISH ALIZARINE COMPANY LTD.

Manchester**London****Glasgow**

Manufacturers of Alizarine Dyestuffs

ALIZARINE RED
(all shades)

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ALIZARINE GREEN
(soluble and insoluble)

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(of all qualities)ALIZUROL GREEN
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ALIZANTHRENE BLUE

ALIZARINE BLUES
(soluble and insoluble)

ALIZARINE CYANINE

ALIZARINE ORANGE

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BRITALIZ MANCHESTER
BRITALIZ LONDON
BRITALIZ GLASGOW

All communications should be
addressed to

The British Alizarine Co., Ltd.
Trafford Park, Manchester

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

[NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

CHEMICAL ENGINEERING AND WILTON'S PATENT

FURNACE CO., LTD., London, S.W. (M., 4/8/23.) Registered July 12, £3,000 debentures (filed under sec. 93 (3) of the Companies (Consolidation) Act 1908), present issue £2,000; general charge; also registered July 20, £500 debentures part of £3,000; general charge. *£5,500. December 29, 1921.

TIDY BETTY, LTD., Leeds, stove polish manufacturers. (M., 4/8/23.) Registered July 17, £1,250 debenture, to J. H. Broughton, Ferrybridge; general charge.

WESTERN LABORATORIES, LTD., London, W., celluloid manufacturers. (M., 4/8/23.) Registered July 14, £350 mortgage, to building society; charged on 11, Hanbury Road, Acton. *£200. May 15, 1923.

Satisfaction

MARLEY HILL CHEMICAL CO., LTD. (M.S., 4/8/23.) Satisfaction registered July 24, £2,500, part of amount registered January 4, 1921.

London Gazette

Bankruptcy Information

LAMBERT, Robert M., 10, Great St. Helens, London, drug merchant. (R.O., 4/8/23.) Receiving order, July 25. Creditor's petition. First meeting, August 9, 1 p.m.; and public examination, November 23, 11 a.m., Bankruptcy Buildings, Carey Street, London, W.C.2.

Notice of Intended Dividend

HIRCHBERG, Leon Maurice, 20, Birchington Road, Stroud Green, and Ely Place, both in the county of London, consulting chemist. Last day for receiving proofs, August 10. Trustee, P. S. Booth, 28, Kimberley House, Holborn Viaduct.

Partnership Dissolved

ROWLES AND SONS (Francis Benjamin ROWLES and Ernest William ROWLES), dyers and cleaners, 13, Castle Street, Luton, Beds, by mutual consent as from July 12, 1923. Debts received and paid by F. B. Rowles, who will continue the business.

Company Winding Up Voluntarily

KLEENIT SOAP AND CHEMICAL CO., LTD. (C.W.U.V., 4/8/23.) P. Stapleton, 27, Waterdale, Doncaster, appointed liquidator. Meeting of creditors, 66, Southcoats Lane, Hull, on Tuesday, August 14, at 2 p.m.

New Companies Registered

COXETER AND SON, LTD., 171-175, Pancras Road, London, N.W.1. Manufacturers of and dealers in surgical, dental, optical and scientific instruments, apparatus and materials, drugs, anaesthetics, and chemical appliances, etc. Nominal capital, £8,000 in 7,000 preference shares of £1 each, and 20,000 deferred shares of 1s. each.

ELLIS AND SONS (1923), LTD., manufacturers of and dealers in chemicals, dyes, etc. Nominal capital, £20,000 in £1 shares. Solicitors: Cohn, Seligman and Bax, 52, New Broad Street, London, E.C.2.

HOUSTON AND WALLACE, LTD., 183, West George Street, Glasgow. Oil and fat refiners. Nominal capital, £4,000 in £1 shares.

LINTOX, LTD., 36, King Street, Cheapside, London, E.C. Chemical manufacturers, drysalts, etc. Nominal capital £100 in £1 shares.

LONDON CASEIN WORKS, LTD., City Press Chambers, 148 and 149, Aldersgate Street, London, E.C.1. Importers, exporters, and manufacturers of, or dealers in, casein, condensed, dried, preserved, and other forms of milk, and the products and by-products thereof, etc. Nominal capital, £2,000 in £1 shares.

WAIPUNA KAURI GUM CO., LTD., Winchester House, Old Broad Street, London, E.C. Producers and refiners of gum, resin, oil, etc. Nominal capital, £90,000 in £1 shares (60,000 10 per cent. non-cumulative preferred ordinary, and 30,000 ordinary).

German Trade and Industry

THE Commercial Secretary at Berlin (Mr. J. W. F. Thelwall) has forwarded to the Department of Overseas Trade the following review, based on the reports of the Prussian Chambers of Commerce, of trade and industry during the month of June.

The month was noteworthy for a further extraordinary depreciation of the mark. On the one hand, this led to a strong revival of trade, with the result that an improvement occurred in many branches of industry, e.g., in the textile, leather, paper, indiarubber, and glass industries. The potash, machinery, and chemical industries were also able to record better sales, and the building market revived almost anywhere. On the other hand, the currency depreciation led to quite exceptional advances in prices, which again caused among salary and wage earners, considerable unrest, the acuteness of which was allayed by the immediate commencement everywhere of wage negotiations. The wage increases agreed upon amounted, on an average, in the first half of June to 55-60 per cent. as compared with May, and in the second half of June to about 60 per cent. as compared with the first half of the month. Unfortunately, a strike took place in the coal district of Upper Silesia, and also, in connection therewith, in the Waldenburg district, in consequence of which the coal production was unfavourably affected. The market conditions in occupied territory continued to develop unfavourably. The pressure of occupation became increasingly greater. The deliveries of coal and coke did not increase in quantity, while as regards quality they became still worse. Coke was produced only to meet the immediate requirements of the foundries and gasworks. The coal supplies also diminished constantly. The time is not far distant, therefore, when deliveries will have to cease.

Chemical Industry

The strong home demand was maintained owing to the heavy currency depreciation which occurred in the course of the month, and it was not always possible to carry out orders promptly. The raw material supply from abroad proceeded without interruption or difficulty.

Synthetic Grey Iron

CARBURISATION tests to determine the feasibility of making synthetic grey iron in an indirect arc rocking-type electric furnace have been made by engineers of the American Bureau of Mines, Department of the Interior, at Detroit. The results were very gratifying, an excellent quality of grey cast iron being produced in every test. The carbon content of the metal was under control. With this type of furnace it was found best to mix some grey iron scrap with the steel scrap in order to get the melting started at a lower initial temperature, and thus avoid overheating the roof. Test bars 1½ in. in diameter were made and broken on 12 in. centres. Deflections as high as 3.65 degrees and breaking strength of 3,000 lb. were obtained. On the evidence of these tests an inspector for one of the large automobile plants in Detroit placed a large order for castings specifying electric furnace.

